BIGHORN SHEEP

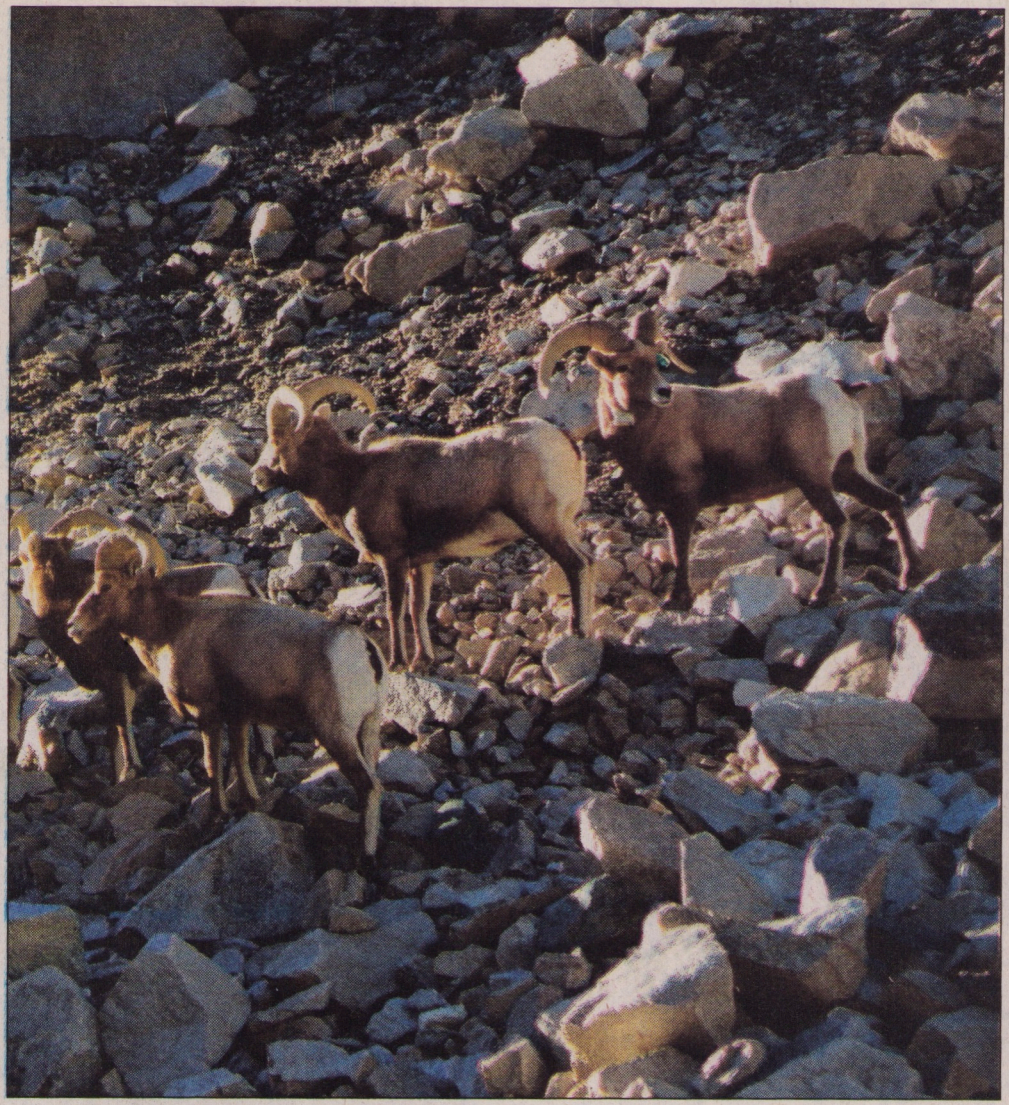
ELK & PRONGHORN SEASON SUMMARIES

Tinemaha and West Tinemaha Period 3 Antlerless	9	10/17/09 - 10/25/09
Tinemaha and West Tinemaha Period 3 Bull	2	10/17/09 - 10/25/09
Tinemaha and West Tinemaha Period 4 Antlerless	9	11/07/09 - 11/15/09
Tinemaha and West Tinemaha Period 5 Antlerless	9	12/05/09 - 12/13/09
Tinemaha and West Tinemaha Period 5 Bull	2	12/05/09 - 12/13/09
Grizzly Island Period 1 Antlerless	2	08/11/09 - 08/14/09
Grizzly Island Period 2 Antlerless	2	08/18/09 - 08/21/09
Grizzly Island Period 2 Bull	2	08/20/09 - 08/23/09
Grizzly Island Period 2 Spike Bull	1	08/20/09 - 08/23/09
Grizzly Island Period 3 Bull	1	09/10/09 - 09/13/09
Fort Hunter Liggett Archery Only Either-sex	3	09/03/09 - 9/07/09
Fort Hunter Liggett Archery Only Antlerless	5	10/08/09 - 10/12/09
Fort Hunter Liggett Period 1 Antlerless	7	10/08/09 - 10/12/09
Fort Hunter Liggett Period 2 Antlerless	8	11/25/09 - 11/29/09
Fort Hunter Liggett Period 3 Bull	7	12/30/09 - 1/03/10
East Park Reservoir Bull Period 1	2	09/05/09 - 10/01/09
East Park Reservoir Period 3 Antlerless	4	09/05/09 - 10/01/09
San Luis Reservoir Either-sex	3	10/03/09 - 10/25/09

Summary of 2009/2010 Pronghorn Antelope Hunting Seasons

11-18-2012

Sierra bighorn: At one point, the population of Sierra bighorn sheep had dropped to about 100 animals, driven close to extinction by mountain lion kills and disease from domestic sheep. Selective lion control has been effective in protecting herds at Pine Creek (now about 115 animals) and Silver Canyon (about 40 animals) in the Eastern Sierra near Bishop. The state total is now about 400. One scientist from Yosemite told me that a new strain of Sierra bighorn has evolved that will not migrate below the snow line in the winter, as the species has done since the ice age, in order to avoid getting eaten by mountain lions.



Strength in numbers 2016

Craig Jackson saw this herd of Sierra Nevada bighorn sheep make its way up a steep rocky slope while Hiking on a climber's trail in Pine Creek Canyon.

The endangered Sierra Nevada Bighorn sheep

By John Wehausen
Sierra Nevada Bighorn Sheep Foundation (www.sierrabighorn.org)

The unique Sierra bighorn sheep have called the Owens Valley home for thousands of years.

Photo courtesy of John Wehausen

One local species to celebrate on National Endangered Species Day, May 15, is the Sierra Nevada bighorn sheep. Every time we look up at the Sierra from almost anywhere in the Owens Valley we are looking at some rugged alpine habitat that Sierra bighorn have called home.

They have called that habitat home for a very long time – 600,000 years, according to their unique DNA! This means they have seen six glacial periods (ice ages) come and go, when glaciers filled and slowly slid down most canyons, and ice covered much of the higher mountain slopes in some regions like Yosemite.

The Sierra Nevada has been very kind to Sierra bighorn by providing these sheep adequate habitat through the ebb and flow of those glacial cycles. As they lost habitat to ice in part of their range, other suitable habitat opened up as timberline dropped in elevation to create more alpine habitat, especially at the southern end of the range – a process that reversed itself at the other end of each glacial cycle. It is the large size of the Sierra Nevada and the high elevations and weather patterns at its southern end that made this possible. The resulting continuity of adequate habitat through time has been a key element that has allowed these sheep to become a separate subspecies in a single mountain range – a phenomenon as rare as the sheep themselves.

5-14-2020

In the current interglacial period, the original distribution of Sierra bighorn extended from the Sonora Pass region south to the most southern alpine in the Sierra, including the Great Western Divide. After encountering domestic sheep beginning about 1860, and their respiratory tract bacteria that cause fatal pneumonia in bighorn sheep, the distribution of Sierra bighorn contracted to a short section of occupied habitat in the region west of Independence. These unique animals narrowly escaped extinction.

Active management to reverse a long trend of population losses began in the late 1970s, but Sierra bighorn were not listed as endangered for another two decades. As a result mostly of restoration efforts over more than 4 decades, the number of herds (geographically distinct reproductive units) has risen from 3 to 14, and total numbers from a low of just over 100 to highs 6 times that in some recent years. This has been an interagency effort led for the past couple of decades by the California Department of Fish and Wildlife out of its Bishop office, aided by the Sierra Nevada Bighorn Sheep Foundation.

We hope Sierra bighorn will be around to survive the next glacial period and many thereafter.

John Muir may have personally seen only a few Sierra bighorn, but his accounts of this mountain sheep introduced bighorn to the world. (Date unknown).

Sierra Nevada Bighorn Sheep are genetically unique. They have evolved in isolation in the Sierra Nevada Mountains for thousands of years. But their success as a species was tested beginning in the mid 1800s.

Some Sierra Nevada bighorn sheep high on a mountain ridge soak in the morning sun above Pine Creek Canyon

12-30-2010

Holy sheep

The day after Christmas found a herd of bighorn sheep visiting the Pine Creek area, apparently forced to low ground by the recent snow. Tommy Bunten was there to capture the stunning scene with his camera. Photo by Tommy Bunten

These skulls show the difference between desert bighorn sheep (left) and Sierra bighorn sheep, and are part of Sierra Bighorn Sheep exhibit at the Mt. Whitney Fish Hatchery.

Photo by Jon Klusmire

Horning In?

Bighorn sheep have made a comeback in recent years, but some developers out West think they're intruders

BY STEVE KEMPER

JOHN WEHAUSEN'S FAVORITE FIELD HAT IS SO TOUGH that its maker guarantees it for life. Wehausen is now sweating through his fourth, which suggests how much time he has spent in the field over the past 26 years pursuing bighorn sheep. Six-foot-two and rail-thin, with a wispy beard, Wehausen began studying bighorn as an excuse to wander for weeks in the mountains, but then the sheep took over his life. Now he clambers after them in California's majestic Sierra Nevada and in the scorched ranges of the Mojave Desert. Most field biologists devote a few years to researching one animal and then move on. Wehausen, scientifically speaking, has been a monogamist.

When I visited him recently at his home in Bishop, California, on the eastern side of the Sierra, I found sheep horns littering the front porch. Inside, I saw skulls with massive flared horns leaning against a living room wall. On the messy kitchen table, piles of correspondence shared space with a hefty trophy given to Wehausen by the Desert Bighorn Council for his "outstanding contribution" to bighorn science. By title, he is a research scientist at the University of California's White Mountain Research Station in Bishop, but he has no office there and works out of his house.

A Rocky Mountain bighorn ram typically curls its lip as part of mating behavior. Horn ends are damaged from fighting.

Over the next few days, I scrambled up and down the steep, rocky slopes favored by bighorn, and learned about wild sheep. I also came to understand, as I panted along behind the 50-year-old Wehausen, why a colleague refers to him as a "pair of lungs with legs."

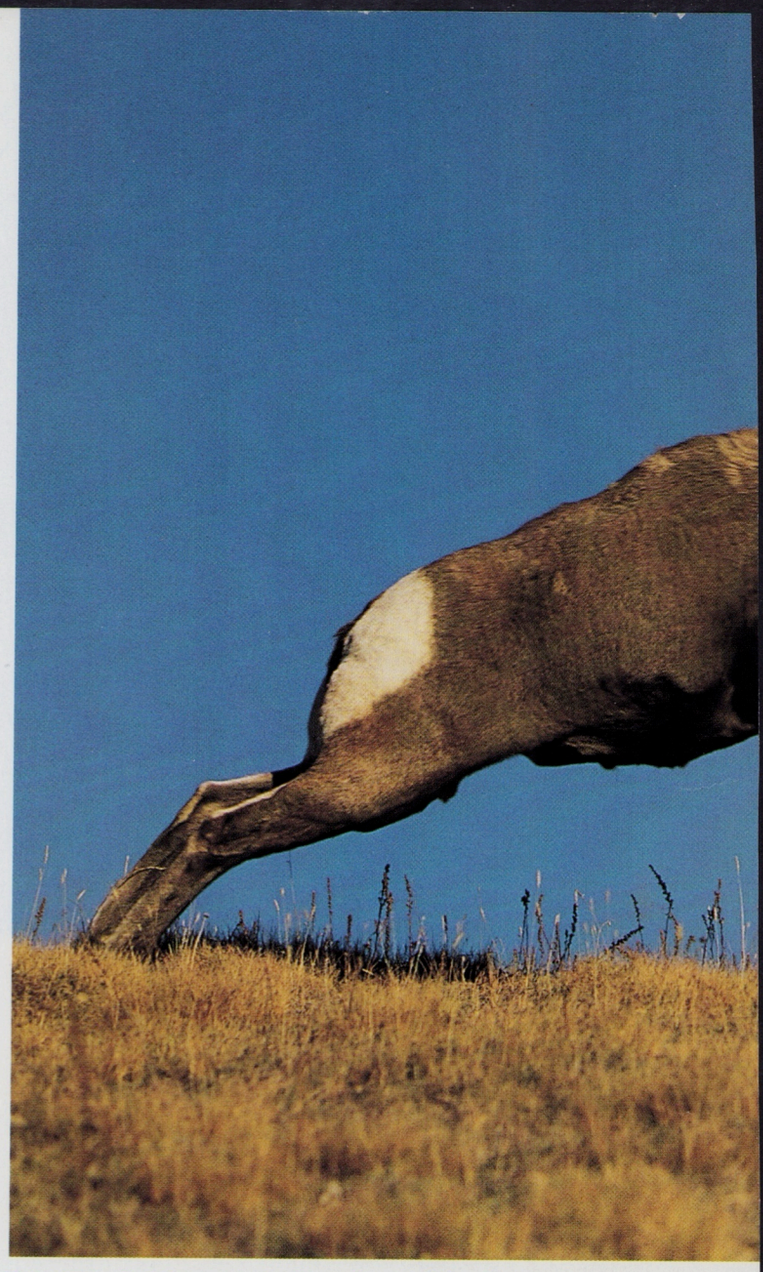
His special passion is the Sierra Nevada bighorn, also known as the subspecies California bighorn. This is one of two groups of bighorn classified as endangered in the United States. In the past decade the Sierra population has plummeted from 300 to about 125. The other endangered population, called Peninsular bighorn, lives in the desert mountains around Palm Springs, California.

Several Indian tribes associated the thick, curled horns with big winds and rains.

Bighorn have symbolized the West's mountains and canyons since the first European explorers gawked at their vertical acrobatics, beginning with Coronado in 1540. They appear frequently in the journals of Lewis and Clark, occasionally as the main course. But Lewis admired their prowess even more than their flavor. In a badly misspelled entry for July 18, 1805, he describes a large herd "on the immencely high and nearly perpendicular clift opposite to us; on the fase of this clift they walked about and bounded from rock to rock with apparent unconcern where it appared to me that no quadruped could have stood, and from which had they made one false step the[y] must have been precipitated at least a 500 feet."

Lewis noticed that Indians fashioned the sheep's horns into cups, spoons, platters and bows. (Wehausen has come across rock blinds along sheep trails in the Sierra, where Indians crouched, waiting for bighorn.) Native Americans had venerated bighorn in rituals and stories for centuries before the arrival of white men. There's a Kilawa tale from Baja California, in which the Creator builds the sky, but it keeps drooping, so he props it up with four bighorn on top of four mountains. To the peoples of the lower Colorado River, the stars of Orion's belt are known as Three Mountain Sheep. Indians carved and painted thousands of bighorn on cliff faces throughout the West, and some ritually cremated the sheep's bones to appease the animals' spirits. Several tribes associated the thick, curled horns with big winds and rains, and wouldn't bring them into their villages, stacking them near watering holes or ceremonial sites.

Mountain sheep migrated to North America from Eurasia over the Bering land bridge more than a half-million years ago. By Coronado's time, bighorn ranged throughout the western half of North America, from Canada to Mexico, from snowy crags to desert ledges, wherever the landscape offered steep, open slopes. They once browsed river bluffs and foothills as well, but pressure from ranchers, miners and settlers confined them to the rugged terrain of mountains. In the mid-19th century, the sheep were hunted commercially; at least one menu from gold rush days listed bighorn as an entrée.



Two rams clash horns in the Canadian Rockies. During the rut, when the opportunity to breed is at stake, it can take many hours before a violent contest such as this is settled.

P. 90 JOE MCDONALD

By the late 1800s and early 1900s, rams were esteemed as trophy animals among big-game hunters, some of whom wrote popular accounts of their excursions. Literary naturalists also brought the sheep to the public's attention. Ernest Thompson Seton's *Lives of the Hunted* (1901) introduced many young readers to bighorn through the dramatic story of "Krag, the Kootenay Ram." John Muir devoted a chapter to bighorn in *The Mountains of California* (1894), calling them "the bravest of all the Sierra moun-

JEFF FOOTT

taineers." After watching three sheep casually climb a steep, icy slope, Muir wrote, "This was the most startling feat of mountaineering I had ever witnessed, and, considering only the mechanics of the thing, my astonishment could hardly have been greater had they displayed wings and taken to flight."

But during those same years, the bighorn was devastated by overgrazing, overhunting, epidemic diseases passed on by livestock (mainly domestic sheep) and habitat loss caused by roads, fences and towns. By the first decades of this century, the subspecies called Rocky Mountain bighorn had been exterminated in Utah, Nevada, New Mexico and Washington, as well as most of Oregon. Another subspecies, the Badlands or Audubon's bighorn, was already extinct, and others were heading in the same direction. By 1960 the North American population had shrunk to about 23,000. Most of the survivors lived in small groups isolated by the fragmentation of their traditional ranges. At that point, science got interested. Biologists began studying the sheep in earnest, and major restoration programs were initiated in several states during the 1970s. Bighorn have been returned to many of their old haunts over the past 20 years, and some groups are prospering. With an overall population now estimated at 70,000 in North America, the bighorn has become a conservation success story. (Another 100,000 to 130,000 thinhorn sheep—Dall's sheep and Stone's sheep—live in Alaska and western Canada.) The sheep have benefited from better science, better conservation and management practices, and the financial sup-

Bighorn like steep, open ground where their agility and eyesight can protect them.

port of groups such as the Foundation for North American Wild Sheep, which thus far has pledged $10 million for a project to restore up to 6,000 bighorn to prime habitat in Idaho's Hells Canyon.

Yet uncertainties cloud this magnificent creature's future. Many herds remain small and vulnerable to catastrophic die-offs triggered by disease or weather. In 1995, for instance, an epidemic reduced Washington's Rocky Mountain sheep by more than half, to fewer than 200, and the herds in Idaho have plummeted. Colorado's sheep population has rebounded to about 7,000 in recent years, but the animals are scattered in 66 isolated herds. By comparison, Wyoming's 6,500 sheep make up just 15 herds. But even in that wide-open state, which has the country's smallest human population and its largest concentration of bighorn—about 700 in Whiskey Basin—the population has declined in the past decade by about 12 percent.

Using radiotelemetry, biologists Stacey Ostermann and Jim DeForge track Peninsular bighorn in the Santa Rosa Mountains south of Palm Springs, California.

Throughout the West, wild sheep are feeling pressure from development and the presence, in some areas, of domestic sheep, plus predation by mountain lions and encroachment by forests. Bighorn like steep, open ground where their extraordinary agility and eyesight can protect them, but years of fire suppression have allowed trees to overgrow much of their former habitat. Many wildlife biologists are now calling for controlled burns to reestablish old territory and open up traditional migratory routes.

The ups and downs of bighorn conservation are starkly illustrated by the sheep Wehausen studies. As soon as I reached Bishop, he took me to Wheeler Ridge in the Sierra, to see what he calls "drive-up sheep"—bighorn visible from a country road. He looked at the immense, steep mountainside for a few minutes and then casually announced, "I see sheep." Despite his precise directions and my good binoculars, it took me a while to find them. They blended perfectly into the mottled landscape of gray rocks, dun ground and dusty bushes. It was a group of nine ewes accompanied by a few lambs "and one 2-year-old male," added Wehausen, after studying the age rings on the latter's horns with a spotting scope.

The sexes don't mingle much except at rutting time. Young males stay with the females for about two years, quickly developing their lifelong habits of strutting and butting. They then join a band of rams, where they are often butted, kicked and even mounted by older, stronger males. Young rams devote their lives to butting their way up the chain of dominance until the happy day when they too can bully other males and rut themselves silly.

Among rams, horn size is all. It determines the only two things that matter to them—their rank in the hierarchy and their chances of mating. A well-fed young male can add four or five inches to its horns each year; a Rocky Mountain ram's may curl nearly four feet, and its skull, including horns, can weigh more than 30 pounds.

At mating time, rams chase females up and down the slopes or hang around the local watering hole to round them up. Older rams do everything possible to keep younger ones from breeding.

And then there's the fighting. Rams joust most seriously during mating season—Wehausen listened to one contest that went on for 24 hours. "They pretend that they're feeding, but they're really watching each other," he says. "And then they'll suddenly turn and go at it. It's such a *crack*, like a rifle shot. You can hear it a long way."

There is what appears to be an almost ritualistic aspect to these clashes. The rams rise up on their hind legs, then smash heads. Immediately afterward, they step back, freeze and, with heads raised at a slight angle, appraise each other's horns. By comparing the force of the impact with the size of his opponent's horns, a ram can get a pretty good idea of his own. That gives him some indication of whether he is evenly matched or in way over his head, so to speak.

CHAD SLATTERY (2)

Surrounded by bighorn skulls, researcher John Wehausen works in the office of his cabin near the snowcapped Sierra, where he spends much of his time studying sheep.

The fights can be vicious. Horns take such a beating that the tips are usually broken off, or "broomed." At the conclusion of the mating season, Wehausen has seen more than one ram with its face nearly skinned from getting hit so often by glancing horns.

The strongest rams with the biggest horns tend to die sooner (at 7 to 11 years) than their less well endowed rivals—probably because they burn out from chasing females and fending off upstart males. The rams' parental involvement ends with the rut. Ewes drop their lambs in the spring. Within days, the young mountaineers learn to scamper up and down steep slopes.

Gray foxes, bobcats and golden eagles are capable of taking a bighorn lamb; wolves, grizzlies and mountain lions have the strength and athleticism to kill big sheep. Wehausen has seen a mountain lion make a successful attack. "A once-in-a-lifetime opportunity," he says. At dusk in the Sierra, he heard small rocks falling and lifted his binoculars to see a group of panicked bighorn scrambling toward the mouth of a canyon. Behind them bounded a mountain lion. Most of the sheep climbed to safety higher on the canyon side, but one 120-pound ewe stopped on a narrow ledge. The lion pounced onto the ledge and balanced there just long enough to bite the ewe in the neck before its momentum carried them onto a sandy flat below, where the lion finished the kill.

Predators must work very hard to nail a bighorn. Even predators with rifles find the sheep eerily elusive. So do field biologists. While chugging behind Wehausen on sheep trails littered with scat, I often thought about a sentence from the 1916 journal of naturalist Charles Sheldon: ". . . tracks were numerous but sheep were scarce." Wehausen says matter-of-factly, "They evaporate." He has suddenly lost them even from the vantage of a helicopter: "We'll turn around and they've just disappeared."

Over the years, hunters—who sometimes pay hundreds of thousands of dollars for a chance to bag a ram—have fabricated some tall stories to explain how bighorn escaped them. One common tale claims that when the sheep get caught at the edge of a precipice, they dive off and land on their horn-encrusted heads, then trot off unharmed. John Muir dryly wondered how ewes survived this, with their

small, spiky horns, and noted that even if a ram's skull didn't crack from such a fall, the rest of his bones would.

Bighorn hearing is mediocre, but the sheep have several other things going for them. First, they live on the open perpendicular, which protects them against attack by most predators. They have a good sense of smell, and their eyesight is superb. It's hard to surprise them, especially if lambs are present or it is windy. Wind unnerves bighorn because when brush is moving, they cannot detect dangerous things prowling through it.

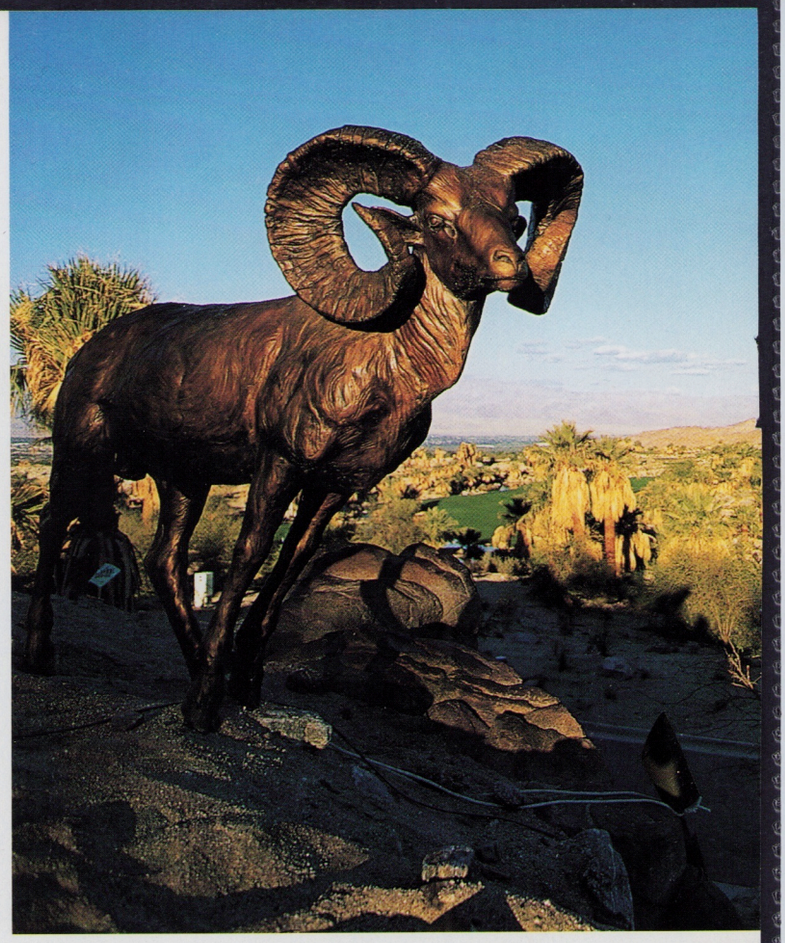
The country-club ways of the endangered Peninsular bighorn sometimes prove fatal.

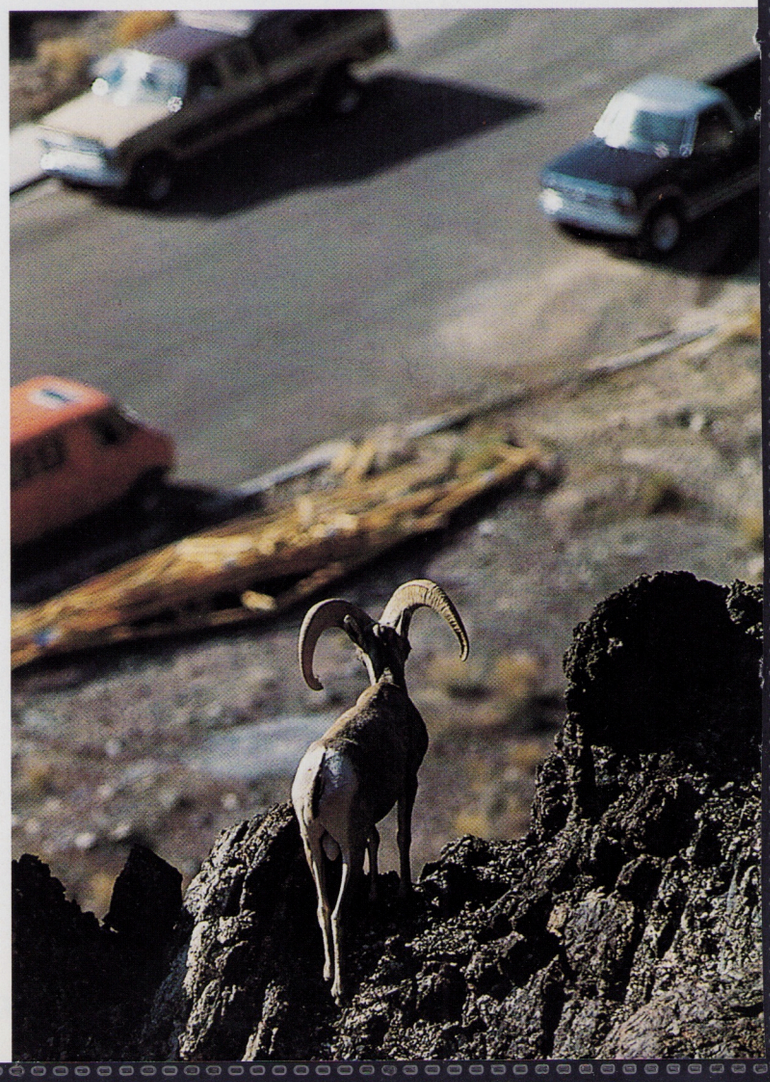
Yet for all their skittishness, they *are* sheep, and sometimes will domesticate to a degree. In his pioneering work, *Mountain Sheep* (1971), wildlife biologist Valerius Geist wrote that some bighorn got so used to him, they would rush up and put their noses into his pockets to lick the salt he carried as a treat. Wehausen has seen bighorn begging along the roads in Glacier and Banff National Parks, and has a photograph of a panhandling sheep sticking its head inside his car window.

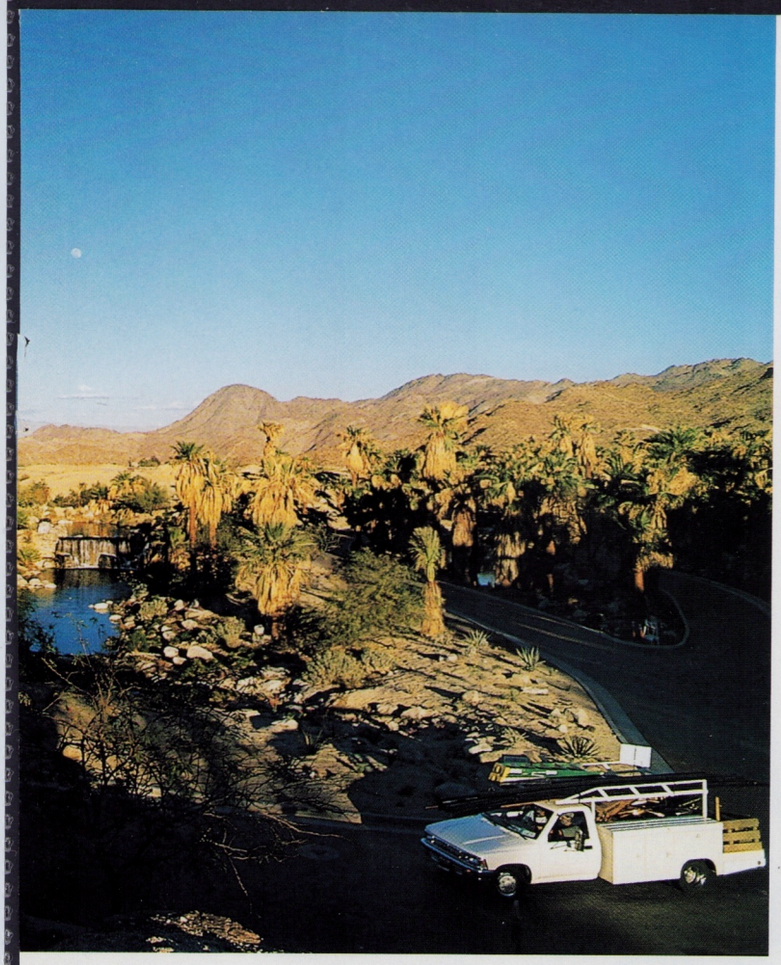
There's an extreme example in Palm Springs, where the country-club ways of the endangered Peninsular bighorn sometimes prove fatal. Jim DeForge, a founder and the executive director of the Bighorn Institute in nearby Palm Desert, drove me to a gated community of million-dollar mansions at the foot of a mountain. We immediately spotted six bighorn grazing on the manicured common. Four big rams came clopping down the street, heading for the same sweet green. DeForge groaned. "That's sad to us," he said. "That's *not* bighorn sheep. But most of these places are used as second homes, so they're often empty and the mountains are close behind for safety. The sheep say, 'Hey! Ice cream! Let's go down!'" DeForge has pictures of them drinking from swimming pools.

But this paradise can be lethal. Because the irrigated lawns are always moist, disease-carrying insects and parasites flourish in them, debilitating many sheep. Oleander, popular among local landscapers, is toxic to browsing bighorn. Then there are the cars. As we drove, DeForge mentioned that seven bighorn had been killed on this short section of the main drag, and several others injured.

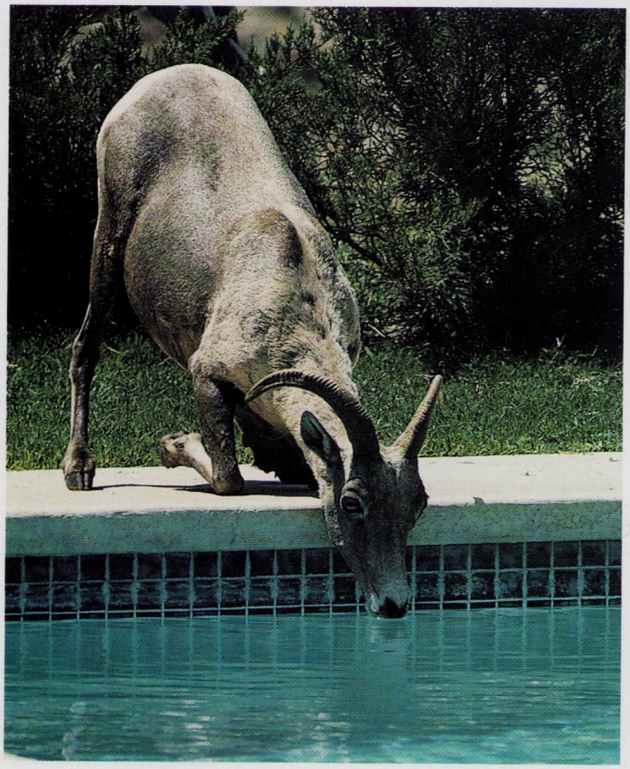
Pressured on one side by mountain lions and on the other by a booming real estate market, these sheep are getting squeezed out. The population of Peninsular bighorn has dropped from 1,170 in 1979 to about 335 now. Most of those live south of Palm Springs. Only 29 adults remain nearby in the northern part of the Santa Rosa Mountains.







Signs of the times: A bighorn statue overlooks a community in California (above) that is named after the sheep whose habitat it displaces; a real ram (opposite) ponders traffic in Boulder City, Nevada; a ewe (below) drinks from a pool in California.



These sheep have been DeForge's life's work. Like Wehausen in the Sierra, he has watched in agony as their population has crashed. The Sierra Club petitioned for endangered status for them in 1991 but faced formidable opposition from developers. Though the sheep were finally declared endangered in 1998, not much has changed for them. The area has nearly 100 golf courses—more courses than sheep, DeForge likes to point out—but new ones are being proposed all the time. Developers routinely sue or threaten DeForge's small nonprofit group for pointing out that their projects will eradicate still more habitat.

Fortunately for the sheep and DeForge, many local people like bighorn, or at least the idea of them. Walk into any souvenir shop and you'll find the sheep's image on T-shirts, mugs and golf balls. Bighorn sculptures adorn city parks and expensive lawns. Rancho Mirage, an affluent area 11 miles southeast of Palm Springs, supports the Bighorn Institute financially, a policy that was challenged recently by developers but approved overwhelmingly by the town's residents.

On the other hand, house lots in the area are selling for up to $1 million an acre, and new golf-resort communities are creeping up the mountainsides. One developer bulldozed hundreds of acres in Palm Desert, named the community Bighorn and stationed a number of sheep statues at the entranceways. If development continues at its present pace, the only bighorn around will be statues.

Aside from field research, DeForge's institute operates a captive-breeding facility that has released 77 bighorn into the surrounding mountains. For his part, Wehausen views captive-breeding as an option of the last resort. He believes the future of Sierra Nevada bighorn rests mainly on translocation, taking a number of sheep from one place where they are doing well and moving them to another place. He is also committed to controlling mountain lion predation—a major undertaking, it turns out. Since last fall, three two-man teams have been working full-time to identify and eliminate problem lions in sheep-recovery areas. Ultimately, a dozen or so cats will be radio-collared and monitored; any found killing sheep will be shot. Similar measures are being taken in several other Western states.

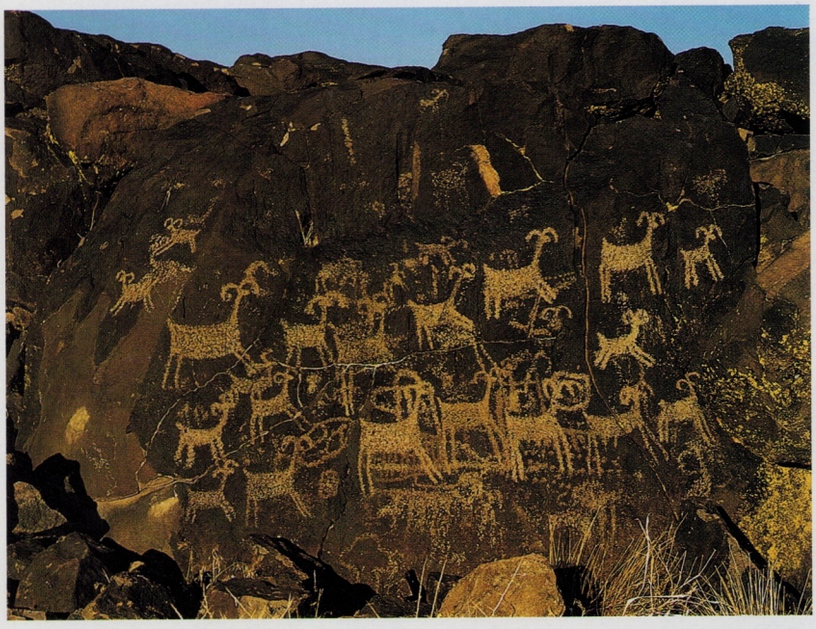
The track record of bighorn restorations is spotty. Scientists from several state and federal agencies recently finished a seven-year study in and near 15 national parks, and found that nearly 60 percent of the restorations failed—the sheep either declined or disappeared. "That's the lowest percentage among big ungulates, which are usually easy to translocate," says Francis Singer, the study's principal investigator. When translocated populations crash, says the report, the main culprits are overcrowding and the proximity of domestic sheep, which pass on lethal infections

Wehausen has noticed several differences between high mountain bighorn and desert sheep.

such as bronchopneumonia, usually through stray domestic sheep or roving bighorn rams, for whom any ewe will do. Such diseases can wipe out entire herds. But this hazard is waning along with the demise of the domestic sheep industry. In the late 1930s, 45 million sheep grazed the mountains of the West. Today there are only 4 million.

Singer's study lists three requirements for successful restorations: a group of at least 25 sheep; a patch of suitable habitat big enough to sustain the herd's growth; a distance of at least 12 miles from domestic sheep.

Wehausen knows as much about bighorn as anyone, yet he believes that much remains undiscovered or misunderstood. Even the taxonomy is unsettled. Biologists have assumed for decades that the species *Ovis canadensis* contains seven races ranging from Rocky Mountain sheep in Canada to desert sheep in Baja California. But new genetic research by Wehausen and his colleague Rob Ramey may reduce the number of subspecies by half.



Bighorn have disappeared from the arid land west of Death Valley where these Indian petroglyphs portray them. The drawings are from 500 to 1,000 years old.

Since the mid-1980s, Wehausen has been driving 300 miles to the Mojave every three weeks in spring, less often the rest of the year, to monitor herds on Old Dad Mountain and in the Marble and Old Woman ranges. "To my knowledge," he says, "I am one of very few sheep researchers who have ever had the privilege of studying both high mountain and desert bighorn."

On one of his trips, we drove up a sandy track after dark and unrolled our sleeping bags beneath the big desert sky. The next morning we climbed into the Marbles, volcanic mountains colored red, gray and ocher, with splashes of black desert varnish. We followed thin trails made by bighorn over loose rocks, which clattered down the steep drop-offs. The footing was treacherous, and some of the scree slopes reduced me to all fours.

It was April, usually the greenest time here, with new grass and tasty wildflowers everywhere, but nothing was blooming, nothing was green. Wehausen called it one of the worst droughts in 15 years. "There's less to eat for the ewes, less milk for the lambs," he said. "I expect very few lambs to survive until summer."

Wehausen has noticed several behavioral differences between high mountain bighorn and desert sheep. Necessity drives desert bighorn to disperse more widely for forage. They spook easier, perhaps because few people enter these inhospitable mountains. Wehausen has found unexpected differences even within neighboring groups of desert sheep. Ewes from the Marbles have emigrated to other ranges; Old Dad ewes rarely stray. Most desert groups eventually visit the water tanks put up by wildlife officers, but one group in the Marbles doesn't drink at all, relying solely on the moisture within forage—for instance, the juicy insides of barrel cactus. Wehausen's assistant once saw two rams butting heads over an open one, alternately taking bites as their mouths passed back and forth over the pulp. He's also seen blood on barrel cacti and spines hanging from sheep's faces and horns.

After several hours in the Marbles, Wehausen spotted a single ewe about 300 yards below us, already dashing away. "I have to go down and see if she left any droppings," he said. As we walked, he had periodically scooped up the ubiquitous droppings and rubbed them between his thumb and forefinger, then put his nose into his cupped hand like a connoisseur of gourmet coffee. "Nuggets of information," he said, grinning. He was testing for freshness, as a clue to the sheep's movements. Down below, we found the ewe's scuff marks in the gravel slope, and a big pile of fresh pellets.

"This is *gold*!" gushed Wehausen. He carefully put them into a bag, which he would add to his collection of similar bags dating back to the 1970s. That's when he began ana-

JIM DEFORGE/BIGHORN INSTITUTE; PP. 96, 97 CLOCKWISE FROM TOP: CHAD SLATTERY; JIM DEFORGE/BIGHORN INSTITUTE; JEFF FOOTT

For 30 seconds, they watched us, and then cantered single file around a bend.

lyzing fecal samples for their nitrogen content, which reflects the nutrition and digestibility of the sheep's diet. "I have the best collection in North America," he said. "It's *so* valuable." The reason: it's now possible to extract DNA from droppings. Wehausen and Ramey hope to identify the genetic makeup of all the adults in his Sierra Nevada study areas and then sample the lambs every year to see how many rams, and which ones, are breeding. They'll be able to tell if inbreeding is becoming a problem, and if necessary they'll import a ram to spice up the gene pool.

We scrabbled up and around. At every new vantage, Wehausen stopped to glass the rocky mountainside. After seven hours without glimpsing another sheep, he decided to call it a day, and we began to descend through a canyon. Of course that's when we saw a group of six on a ledge 200 yards above us. For 30 seconds they watched us watching them, the natural aristocrats of the heights, and then cantered single file around a bend. Wehausen climbed to see if they had left any gold in them thar hills.

A precocious lamb demonstrates its agility, bounding across steep terrain. Youngsters must contend with predators, disease and sometimes malnutrition from poor forage.

Waiting for him, I wondered: Doesn't it get tedious driving 600 miles every three weeks? Doesn't it get stale working on the same animal for 25 years? Wehausen said no. He doesn't tire of bighorn because something unusual always happens to lure him on, like that year's severe drought. He wants to see how it affects survivorship and reproduction—he wants the data.

"I see people study something for three years and then draw conclusions," Wehausen explained, "but I could take *any* three years of my data and the conclusions from it would be incorrect or incomplete. We don't have many long-term data sets like mine. I've tried to build predictive models and not one has ever worked, because ecology is so complicated."

The sheep keep surprising him. In the mid '80s, all five Sierra Nevada herds abandoned their normal winter ranges at about 5,000 to 7,000 feet and began wintering as high as 12,000 feet, apparently to escape mountain lions. The snows were deep, the forage poor. The change startled Wehausen. According to the literature, bighorn were creatures of almost inflexible habit, and yet here were five independent populations responding quickly and radically to a new threat.

Unfortunately that change led to poorer nutrition, which caused the ewes to postpone lambing from late April to early June, so they could strengthen themselves first on spring forage. This delay meant one month's less nourishment before the lambs faced the Sierra winter. Add to that the poor forage on the higher winter ranges, and the result was a high mortality rate for lambs.

"I was watching my life's work being destroyed," said Wehausen, as we stood at the base of Wheeler Ridge in the Sierra, watching sheep. He was feeling a bit better about this particular herd at the moment. In 1999, for the first time since 1985, most of this group returned to its old winter range at 7,500 feet, where the forage is better. They returned again this year. In 1995 the herd was down to 18 sheep, but since then the mountain lion population has been significantly reduced here. Wehausen figures there are more than 50 sheep now. "This group is our hope for the future," he says.

The next day Wehausen took me to Tioga Pass, high in the Sierra. He spotted two rams silhouetted on a rugged ridge far above us. Lofty, regal, remote, they transformed the skyline, charging it with vitality and mystery. When they vanished, the landscape dimmed a little.

Steve Kemper has written 11 stories for SMITHSONIAN, *most recently on beluga whales and poisonous creatures.*

W. PERRY CONWAY

BIGHORN

Sheep of the Sierra Nevada

After 130 years of decline, are they making a comeback?

Text and photos
by Mike McWherter

The year is 1834, spring in the Sierra Nevada. A herd of bighorn rams is browsing in the shadow of Mt. Langley. Nearby a pregnant ewe is making her way to higher and more rugged terrain to give birth to her lamb. Momentarily she stops to notice a dust cloud far below in the Owens Valley and then continues on unconcerned. The dust cloud disappears. Joseph Walker's expedition into the Owens Valley has temporarily come to a halt. His group is the first white men to enter the Owens Valley and is a prelude of what will spell doom for the Mt. Langley rams, the ewe, her lamb, and subsequent offspring.

During the next 150 years bighorn occupying other areas of the Sierra, from south of Walker's Pass to Donner Pass, are to see a steady tide of immigrants, settlers, miners, hunters, domestic sheep, trail builders, and recreationists. But as the surge builds, Sierra bighorn herds disappear. One of the first herds to vanish occupied the

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Donner Pass area, gateway for the gold-seekers of 1849. But other herds would also disappear: bighorn of the Kaweah Peaks, Rock Creek, Yosemite, and of course the Mt. Langley herd. By 1979 only one viable herd, on Mt. Baxter, remained, totaling about 220 individuals. The only other herd, on Mt. Williamson, is a remnant herd of about thirty individuals, whose future is uncertain.

Before white men came to California, bighorn were numerous along the Sierra crest. The bighorn of the Sierra, like other North American bighorn, trace their origin to ancestral Asian types. During the Pleistocene epoch, great ice sheets covered large expanses of the northern latitudes. It was a time when representatives of the sheep genus *Ovis* were spreading throughout Asia, eventually finding their way across the Bering Straits, perhaps on some ancient land bridge exposed by water locked up in the advancing glaciers. By the late Pleistocene, members of *Ovis* had established themselves in the mountainous areas of North America. Today, the modern descendants of these ancestral North American types are divided into two groups or species according to their horn structure. They are the "thinhorn" and the "bighorn." The thinhorn (*Ovis dalli*) includes the Alaskan white Dall varieties and the black Stone's sheep found in the Yukon and British Columbia. The bighorn (*Ovis canadensis*) occur south of the Peace River in Canada to nearly the tip of Baja California and east to the badlands of the Dakotas. The bighorn comprise seven subspecies or races. Bighorn of the Sierra are one of these races and their decline occurred with the arrival and activities of white men in California.

After Joseph Walker's entry into the Owens Valley in 1834, many others followed. California held the lure of promise. For many, there was fertile soil on which to settle and to start a new life. For others, there was the promise of instant wealth in the gold fields of the Mother Lode country. They continued to come: explorers, adventurers, settlers, and miners. California's scant population of 2,000 Americans at the time of the discovery of gold in 1848 had swelled to over 53,000 by the end of 1849. A year later California was a state. The growth continued. By 1873 there seemed to be clear evidence of the bighorn's decline, for the California Legislature was prompted in that year to make hunting of them illegal, a law

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Bighorn *continued*

which still protects them today.

More disastrous to the bighorn than the early miners and settlers was the arrival of sheepherders, driving their flocks up the mountain valleys and into bighorn habitat. Domestic sheep were destructive on mountain vegetation and they carried scabies--a decimating parasite for bighorn populations. Until the 1930s domestic sheep received almost no governmental management. About this time the U.S. Forest Service, which managed much of the land considered to be bighorn habitat, began reducing permits for domestic sheep that grazed on known ranges. In 1940 a proposal was made to establish a sanctuary for the largest remaining herd in the Sierra. It was turned down by the Forest Service and California Department of Fish and Game on the basis that more information was needed, and it was not believed that existing policies were having an adverse effect. Ten years later, in 1950, a study was made of the remaining bighorn in the Sierra with the conclusion that only five herds remained (bighorn expert John Wehausen has suggested that there were fewer), probably totaling less than 400 individuals. Twenty more years passed (thirty since its proposal in 1940) before a sanctuary of 41,000 acres of Forest Service land in the Mt. Williamson and Mt. Baxter areas was set aside in 1971. The action was based upon the belief that human disturbance was adversely affecting bighorn. By 1978 only two herds remained totaling about 250 individuals.

As of 1975 the prospect of Sierra bighorn herds regaining a foothold in areas from which they disappeared seemed only a hope. In a study by Geist (1971) an important characteristic of all bighorn was documented: bighorn rarely expand their range or colonize new areas on their own, preferring to occupy their traditional home range. Thus it became clear that if Sierra bighorn were ever to be restored to even a fraction of their original range they would have to be reintroduced into these new areas. In a study supported by the U.S. Forest and National Park Services, which began in 1974 and spanned five years, bighorn expert John Wehausen was able to recommend that the Mt. Baxter herd was a viable enough population to be used as stock for bighorn transplants in other parts of the Sierra. Other important results of Wehausen's study, which also formed the basis for his PhD thesis, were the collection of data on the distribution, numbers, and population trends of both the Mt. Baxter and Mt. Williamson herd. He also determined the suitability of other areas of the Sierra for bighorn reintroduction. Two of these areas, Wheeler Crest and Mt. Langley, were chosen as future sites for the reintroduction.

The time was right to try something which had never before been attempted for Sierra Nevada bighorn, i.e. their reintroduction from existing stock. Would biologists be able to capture the elusive bighorn in sufficient numbers? How would the bighorn themselves react to the trauma of being captured and transplanted to a new home? Would they be able to survive, let alone increase their numbers in their new homes?

Richard Weaver, of the California Department of Fish and Game, had spent the greater part of his career working with bighorn. His extensive knowledge and experience has earned him the reputation of "Mr. Bighorn" in California. Weaver would coordinate the capture and transplant operation. He admitted that he was nervous since live trapping of wild animals is a tricky operation. Employees of the California Department of Fish and Game, National Park Service, U.S. Forest Service, Bureau of Land Management, and volunteers joined in. The entire operation was carefully studied and rehearsed. It was decided to undertake the capture during winter when the bighorn migrated to the lower slopes of Mt. Baxter. Apple pulp and alfalfa were used to entice the bighorn to come under a large drop-net. On March 6, 1979, nine bighorn were safely captured near Sawmill Canyon. Four were pregnant ewes, three were rams, and two were lambs. They were transported 38 miles north and released in Pine Creek Canyon below Wheeler Crest.

The nine bighorn remained low on the Wheeler Crest for the remaining part of the 1979 winter. They moved higher as the winter snows melted. The

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four ewes each gave birth to a lamb. By summer the animals had moved to the 12,000 foot level on the Wheeler Crest and appeared to be adapting well to their new home. The end of fall and the first winter storms traditionally signal bighorn to move to lower and warmer elevations. But for some unknown reason only one ewe and lamb descended. The other bighorn remained in the colder regions above the snowline, an action which likely resulted in the deaths of two of the lambs.

On January 2, 1980, Louis Andaloro and Rob Roy Ramey II, students from the University of Santa Cruz, took over the monitoring of the Wheeler Crest herd. They had volunteered for this difficult and important task as part of their thesis projects at the University. On the morning of January 13 they discovered that one of the radio transmitters attached to an ewe had stopped transmitting. The transmitter was being used to track the ewe's progress. Andaloro and Ramey went to the area where they had last seen her in order to make visual contact. They never found the ewe but instead found tons of snow from an avalanche and several coyotes which were working over a lamb's fresh pelt. They searched several more days in the snow from the avalanche and eventually uncovered a ram that had also died. The lamb and one of the original nine bighorn reintroduced had certainly perished in the avalanche and in all probability the ewe had also similarly perished. Of the remaining three lambs, two were known to have died of other causes. The Wheeler Crest herd had gained one new lamb, with the loss of an ewe and ram.

The following spring, on March 27, 1980, Richard Weaver and his team were able to capture another 31 bighorn from the Mt. Baxter herd. Ten were released in the Warner Mountains in Northeast California. Another ten bighorn were introduced in the Lubkin Creek area of Mt. Langley. The remaining eleven were taken to the Wheeler Crest area to join the group that had been introduced the previous winter.

The group of bighorn released on Wheeler Crest on March 27, 1980 remained separate from the original herd. This new group scattered over a wide area and ranged independently until mid-April. The only mature ram in this group was killed by a mountain lion during the first week. It would seem that bighorn would be more susceptible to predation if they were ranging independently in a new area. But Andaloro observed that two other bighorn predations on Mt. Langley had one thing in common with the bighorn predation on Wheeler Crest--all three animals were radio collared with a telemetry package of highly reflective surface, making the bighorn visible to predators at great distances.

Once again winter arrived on Wheeler Crest. Seventeen bighorn descended to lower elevations. Although the animals formed small groups and were scattered over a wide area there was mixing among the two herds. Possibly four new adult deaths had occurred. If this were true the total deaths since the first reintroduction would be seven (the four new adult deaths, the ram killed by the mountain lion, and the two adults killed in the avalanche). The twenty bighorn introduced would have resulted in a herd size of seventeen. A recent conversation with Tom Blankinship, Wildlife Biologist with the California Department of Fish and Game at Bishop, revealed as of fall, 1981, the Wheeler Crest herd had increased to twenty-three. So it appears that the Wheeler Crest herd may be successful. Blankinship also pointed out that recently a mountain lion was working in the Mt. Baxter area and appeared to have a preference for bighorn. With the numerous factors which can determine population numbers it will be, as Weaver says, a few years before we can really know if the reintroduction has been a success.

As for the bighorn introduced in the Mt. Langley area there remains a big question mark. The ten bighorn introduced in March, 1980, near Mt. Langley appeared to be staying together up to April. After April they had scattered. The largest group subsequently observed numbered only three. The summer range of the rams remained unknown. One animal is believed to have moved north and joined the Mt. Williamson herd. Andaloro believes that no more than six or seven bighorn remained as of fall 1980. Even today their status is unknown.

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***Bighorn** continued*

The most recent capture of Sierra bighorn occurred on March 31 and April 1, 1982. A total of nineteen bighorn were captured from the Mt. Baxter herd in the area of Sawmill Canyon. Fifteen were taken and released in the Lubkin Canyon area near Mt. Langley. Nine of these bighorn were fitted with radio collars for monitoring. Four of the nineteen were released in the Wheeler Crest area and all were rams. These rams were also fitted with radio collars. Although the Mt. Langley herd's past has been doubtful, the additional fifteen bighorn introduced there makes things much more hopeful. Tom Blankinship, who has the responsibility of overseeing the welfare of bighorn in the Sierra, expressed optimism about the reintroduction of bighorn in the Sierra. He pointed out successful reintroductions which have occurred in Wyoming, Nevada, Arizona, Oregon, Colorado, Montana, Utah and Washington.

To date 59 bighorn have been taken from the Mt. Baxter herd. Since the Mt. Baxter herd has increased in number during the last few years the taking of 59 bighorn from this herd will not result in a lower population in the Mt. Baxter herd than when the reintroduction program began. If the reintroduction program is a success, the survival of these magnificent animals will be assured. Such reintroductions are important to us who know and love the Sierra. These reintroductions emphasize the need to solve the even bigger problem of bighorn decline throughout California. The decline of Sierra bighorn is part of a more general problem of bighorn decline in California. It is a statewide problem. Most bighorn populations in the mountainous regions of the California desert are on the decline. In particular, bighorn in Death Valley National Monument are experiencing a decline due to a number of factors such as competition with feral burros, decreasing water resources, and loss of habitat. If the decline of bighorn in California is to be stopped, and hopefully reversed, such programs as we have seen for the Sierra bighorn must continue. The survival of these majestic creatures, not only in the Sierra but throughout California, depends upon an informed and concerned public which is willing to support programs designed to safeguard bighorn numbers.

We all hope that the reintroduction of bighorn in the Sierra will prove successful. Most of us associate bighorn with the head-crashing bouts for which they are so well known. During the rutting season rams determine who will make off with a willing ewe, which has just come into heat, by engaging in head-crashing bouts which send them flying toward each other at speeds estimated between 50 and 70 miles per hour--impacting with forces up to 2400 pounds. The sound of their crashing horns, reverberating off canyon walls, is accompanied by a brief moment when heads seem to be welded together. If the reintroductions are successful and bighorn numbers increase, perhaps in the future it will not be a rare experience to sight the magnificent creature standing atop a rock pinnacle in his rugged mountain habitat. Some of us may even be lucky enough to witness the rutting of the rams. ■

2013 NEWS LETTER

SIERRA NEVADA BIGHORN SHEEP FOUNDATION

December, 2013

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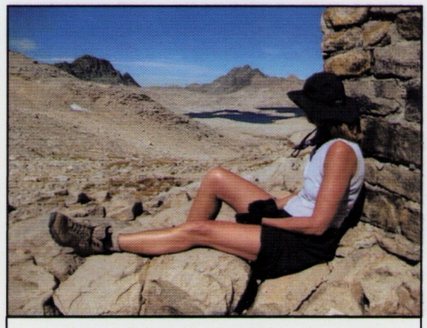
ALL WHO WANDER ARE NOT LOST

Meet Cris Chater. New SNBSF Board Member

Two years ago in late September, I was heading north on the John Muir Trail. I stopped to appreciate the view on Pinchot Pass and contemplate several life changes that were facing me. I was "looking for a sign" to help guide me in the right direction. As I descended the pass, I heard what I thought was a rock slide only to find a herd of 12 female Sierra Nevada Bighorn Sheep crossing in front of me.



Cris Chater takes a break to enjoy the view from the Muir Hut.

This was the first time that I had ever seen a Sierra Nevada Bighorn in my 16 consecutive years of hiking the JMT. I stood frozen in my tracks, holding my breath and trying not to blink. I was stunned and in awe of these beautiful wild animals. They too were motionless, watching me. We stared at each other for what seemed like an eternity, but lasted less than a minute. I didn't dare move my head and lose sight of them; after all, they are the same color as the ubiquitous granite of the High Sierra. Eventually they scampered up the mountain. Before they disappeared over the ridge, the last ewe paused briefly on top of a boulder, looked back and nodded her head before she followed her sisters out of sight.

As soon as I returned home, I called the Sierra Nevada Bighorn Sheep Foundation and met Dr. John Wehausen, who invited me on a sheep trek at the end of that year. John has spent the past 40 years working to protect this magnificent yet endangered species. His passion for helping preserve what John

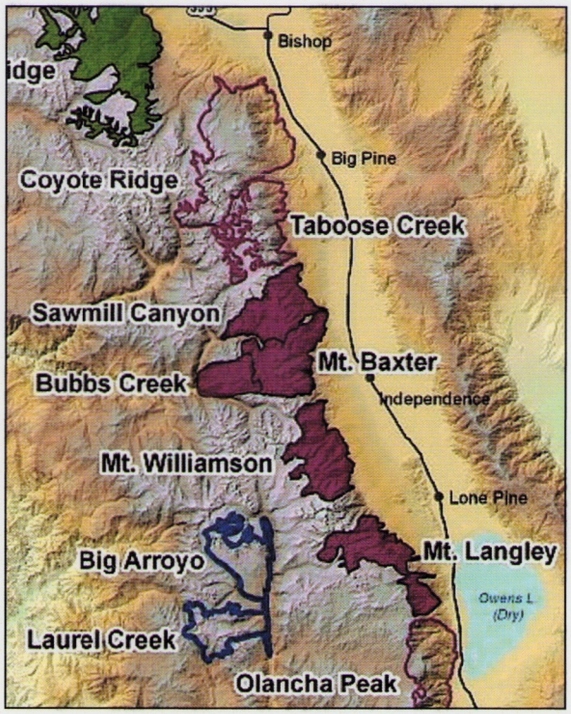
Muir described as the Sierra's bravest mountaineer is contagious.

I was so inspired by my chance encounter with the herd of bighorn sheep that I was determined to learn more about them. The more I learned the more I was inspired to help the Sierra Nevada Bighorn Sheep Foundation accomplish its mission. I became a donor, moved to the Eastern Sierra and was invited to join the foundation's board. The recovery of the Sierra Nevada Bighorn Sheep is an inspiring success story; not long ago the bighorn numbered just 100 and could easily have gone extinct but has now has increased to 500 and rising.

Thanks to the Sierra Nevada bighorn sheep's endangered status, Dr. Wehausen's research, the California Department of Wildlife Recovery Program and philanthropic support, the sheep are making a remarkable recovery. Please join me in donating generously to this worthy cause, thereby insuring that their recovery continues. Right now your donations are needed more than ever.

Bighorn Reintroduced to Olancha Peak

The current populations of Sierra bighorn at Mount Langley, Wheeler Ridge, and the Mono Basin stem from sheep caught from the native Mount Baxter and Sawmill Canyon herds during 1979-88 and moved to those 3 locations. That restoration program was initiated by our foundation president, John Wehausen, after he determined as a graduate student that the Mount Baxter and Sawmill Canyon source herds together numbered at least 220 sheep and could sustain removals. However, that restoration effort was put on pause in the late 1980s after unanticipated changes in seasonal habitat use patterns occurred in all Sierra bighorn populations, followed by widespread population declines. Those changes ultimately led to these sheep receiving state and federal endangered status. When reintroductions ceased in the late 1980s, it was never imagined was how long that pause in the restoration effort would be. In 2012 the recovery of these sheep reached a milestone when the total population crossed 500. This year marked a different milestone when the first new population was initiated in 25 years. The location was Olancha Peak, which contains the southernmost alpine habitat in the Sierra Nevada. Compared with other herd units to the north, the amount of alpine habitat for this herd is very limited. However, there is extensive low elevation winter range and good historical evidence that a population once occurred there; consequently, the recovery plan for these sheep called for this herd unit to be occupied as part of the requirements for down-listing to threatened and ultimate removal from the federal endangered species list.



The California Department of Fish and Wildlife (CDFW) carried out this reintroduction, as they did the previous ones. However, the 25 year hiatus in reintroducing Sierra bighorn allowed an additional new technology to be brought in, for which our foundation played a key role. When bighorn sheep were caught and moved during 1979-88, the only selectivity was by gender, with an emphasis on creating a founding reproductive base of females of adequate size, and enough total sheep introduced to hopefully maximize genetic diversity in the new population. At the time nothing was known about

levels of genetic diversity. In the late 1990s John Wehausen began extracting and freezing Sierra bighorn DNA obtained from their droppings, dried scraps of tissue on old skulls, and eventually blood samples from sheep caught for radio collaring. Those DNA samples were used to develop pertinent genetic measures, and that sampling was then expanded geographically, first to desert bighorn east of the Sierra Nevada, and eventually further south across desert bighorn range as far as New Mexico. This has allowed data from the Sierra Nevada to be interpreted in a larger context. One of the important genetic variables is heterozygosity, which is a measure of genetic diversity at both the individual and population level, and reflects levels of inbreeding. Sierra bighorn have the lowest genetic diversity of all non-captive bighorn sheep populations sampled. This can be attributed to the extirpation of most native populations and probable repeated major die-offs due to diseases from domestic sheep in the herds that survived. Sierra bighorn apparently narrowly escaped disappearing entirely, but carry a clear genetic scar of that recent tumultuous history. While recent strong gains in multiple populations indicate that lowered genetic diversity is not so extreme that it will preclude demographic recovery of these sheep, they may be near a tipping point where inbreeding negatively affects some sheep at the lower end of the heterozygosity scale. An analysis by Heather Johnson as part of her 2010 Ph.D. dissertation found evidence of this.

The relatively low genetic diversity among Sierra bighorn raises a fundamental question of how genetics should be brought into decisions about catching and moving sheep for restoration efforts. The populations created during 1979-88 all show somewhat lower genetic diversity than the parent herds used as translocation stock. Would it be possible to initiate new herds in a way that would create herds with at least the genetic diversity level of the native Mount Baxter and Sawmill Canyon herds? That was one question that John Wehausen posed early this year in a memo to key decision makers within the CDFW recovery program for these sheep. In that and a followup memo, different approaches to selecting sheep for initiating new populations were compared. This question could be analyzed because (1) a large genetic data base on Sierra bighorn existed that could be used to examine the genetic implications of different strategies for selecting sheep for reintroductions, and (2) a large number of Sierra bighorn are currently collared, some of which could be selected for reintroductions based on their heterozygosity levels. Through our president, our foundation provided CDFW genetic data on all Sierra bighorn that carried collars to allow some individuals to be selected for translocation on the basis of their heterozygosity levels. The approach chosen for Olancha Peak was to capture 10 uncollared females at random from the native Sawmill Canyon herd and from multiple populations about half that many collared males selected for high heterozygosity. Since that reintroduction we have determined the heterozygosity levels of the 10 translocated females and found that all but one was above average for the Baxter/Sawmill gene pool, which bodes well for the future genetic diversity level of the Olancha Peak herd. However, there were additional sheep reintroduced *in utero*. Tom Stephenson, the CDFW program leader, used ultrasound to determine that all of the 10 females released at the base of Olancha Peak were pregnant. In October John Wehausen was able to obtain fecal samples from all lambs in the Olancha Peak herd and will soon determine their heterozygosity levels and genders. Next year he will do the same for the next lamb crop that will reflect matings involving the rams selected for their genetic constitution. He will also determine the parents and gender of each lamb. Once a ram is documented to breed for 2 consecutive years it will be important to re-capture that ram and move it to another population to preclude the possibility of it breeding its own off spring. Such inbreeding would undermine the effort to maximize genetic diversity in this new population. This is cutting edge restoration ecology; stay tuned for future reports on this.

Genetic Rescue Begins at Mount Gibbs

Bighorn sheep in the Mono Basin stem from translocations to Lee Vining Canyon in 1986 and 1988. In the summer of 1986, three translocated ewes with two lambs born in Lee Vining Canyon crossed the Tioga Pass road and headed south across Mount Dana to Mount Gibbs where they found favorable habitat. One of the lambs was male and in 1988 a couple of lambs were born to these ewes; but shortly thereafter a mountain lion killed the young male and additional sheep. Thereafter there was no reproduction until after a couple of rams exploring from Lee Vining Canyon found this declining herd in 1991. Nevertheless, by 1993 only a single ewe remained as the reproductive base and that situation persisted until a female lamb born to her in 1995 reached adulthood two years later. In 1996 an additional ram joined this herd, presumably another immigrant from the Mount Warren herd to the north.

In 1998 all remaining ewes in Lee Vining Canyon permanently abandoned use of that winter and spring habitat coincident with a mountain lion hunting them there. Most took up residence in Lundy Canyon to the north, but in 1999 a new ewe appeared in the Mount Gibbs herd, known for a year only as unique genetic data developed from DNA obtained from a fecal sample. At the time, her addition to this population raised the reproductive base by 50% to 3 ewes. From that level the population grew slowly, eventually reaching 8 adult ewes, 1 yearling ewe and 16 total sheep a decade later in 2009, but has declined a bit in recent years. The only additional known migration to this herd was a ram that in the fall of 2002 headed south from Mount Warren to Laurel and Bloody Mountains just south of Mammoth Lakes and back again the next fall. That ram tarried a bit at Mount Gibbs during the breeding season and may have contributed genes to this small gene pool.

Genetic drift is a pervasive and powerful force in small populations that steadily erodes genetic diversity in isolated populations eventually leading to inbreeding depression, and the smaller the population, the faster the erosion. This steady loss of genetic diversity can be countered by animals that move between populations and breed. The documented immigrants at Mount Gibbs herd might be seen as important events in this regard. However, the Mount Gibbs population was too small for too long, and that immigration was not enough to stem a declining trend in heterozygosity that is now apparent. This was the other issue that John Wehausen presented to our colleagues in the CDFW recovery program early this year, along with some potential options for beginning to reverse this trend, while also developing a better understanding of the influence of inbreeding on the demographic health of the Mount Gibbs herd. At the same time that sheep were caught for Olancha Peak, three previously collared ewes with higher heterozygosity levels were caught and released at Mount Gibbs. Two of those ewes were pregnant. Their lambs have been documented repeatedly this past summer and droppings from those lambs also have been collected for genetic analyses, as well as from lambs born to the other ewes in this herd. DNA has been sampled and analyzed for every member of the Mount Gibbs herd since 1998. Development of genetic data is one of the critical contributions that our foundation makes to the Sierra Nevada bighorn sheep recovery effort. For the Mount Gibbs herd it will be essential to continue to monitor it genetically to measure the effects of this year's augmentation and to provide a basis for future decisions on continuing genetic rescue actions. Expect future articles on this topic also.

EYEWITNESS ACCOUNT: The Tsunami's Toll on a Seabird Sanctuary

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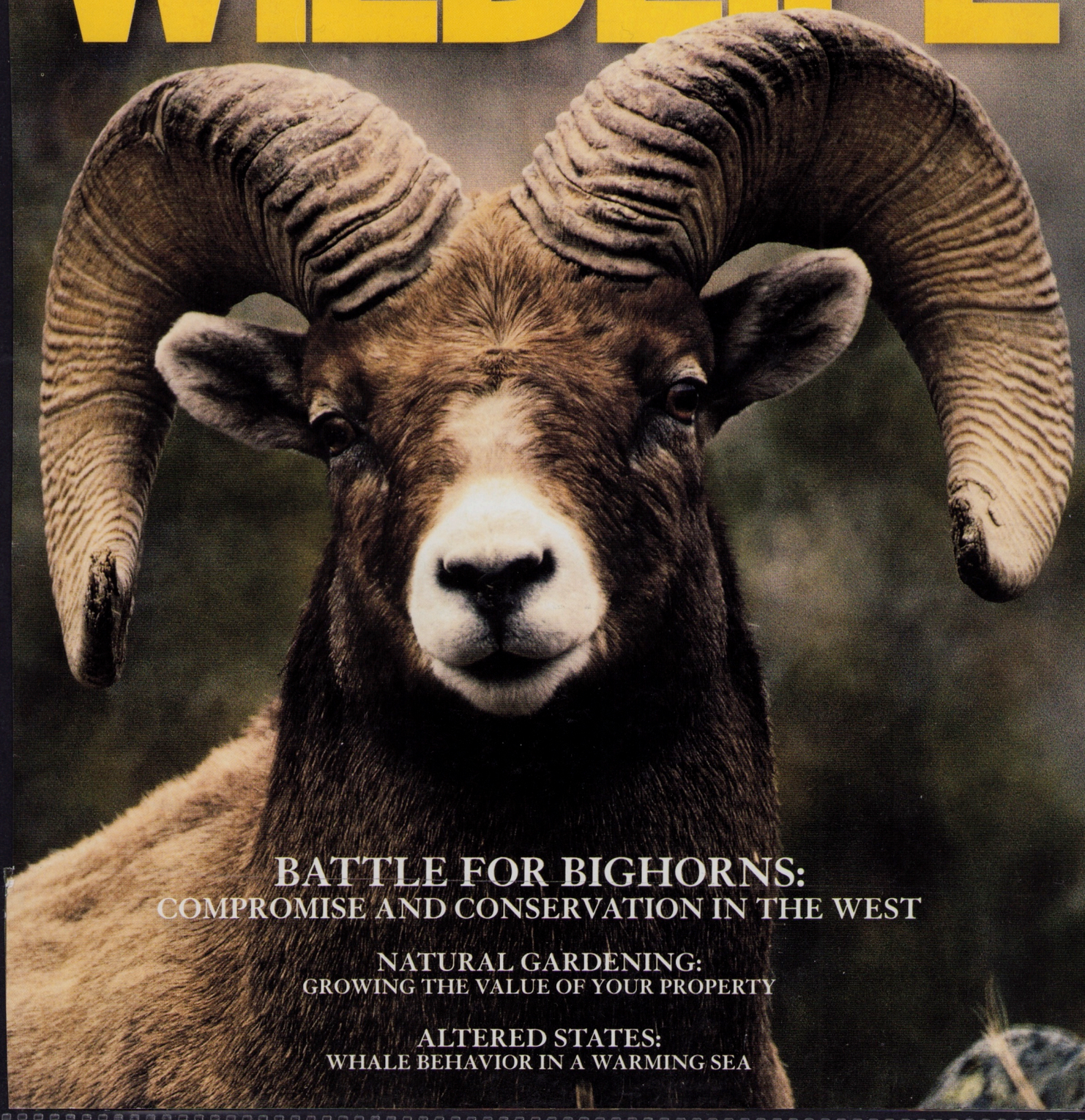


BATTLE FOR BIGHORNS:
COMPROMISE AND CONSERVATION IN THE WEST

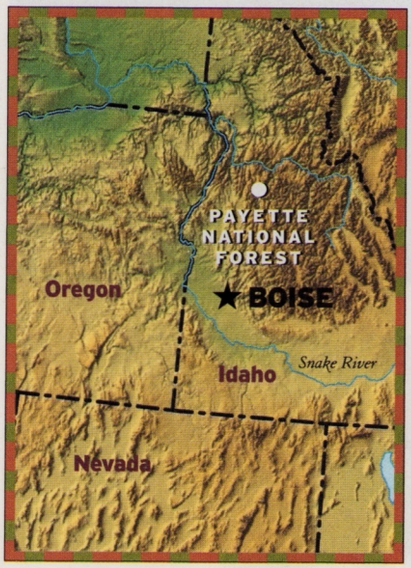
NATURAL GARDENING:
GROWING THE VALUE OF YOUR PROPERTY

ALTERED STATES:
WHALE BEHAVIOR IN A WARMING SEA

A seven-year-old bighorn ram, radio collared as part of a study by biologists of the Nez Perce tribe, stood on a bluff overlooking rancher Mick Carlson's corrals one day in May 2009. His coat gray with age, the ram was no stranger to Carlson's ranch, which lies in the Salmon River Canyon east of Riggins, Idaho, on the edge of the Payette National Forest and a stretch of Bureau of Land Management (BLM) grassland. The radio collar showed that the ram had visited Carlson's ranch frequently. He was a member of a native bighorn population that roams more than 25 miles up and down the Salmon River Canyon through the Frank Church-River of No Return Wilderness Area.

The ram didn't cut the majestic figure that has made Rocky Mountain bighorn sheep iconic in the American West; he was coughing and sneezing from pneumonia. This very disease has killed more than 1,000 wild sheep in recent years in more than a dozen herds across the West. It is a disease that can be passed to bighorns from their domestic cousins and that has been implicated in a developing crisis: After 70 years of growth, bighorn numbers began dropping steadily in the 1980s. Rocky Mountain bighorn sheep populations in the United States, Alberta and British Columbia were estimated in 1998, the most-recent date for reliable figures, at fewer than 30,000 animals, less than half of their number a few years earlier.

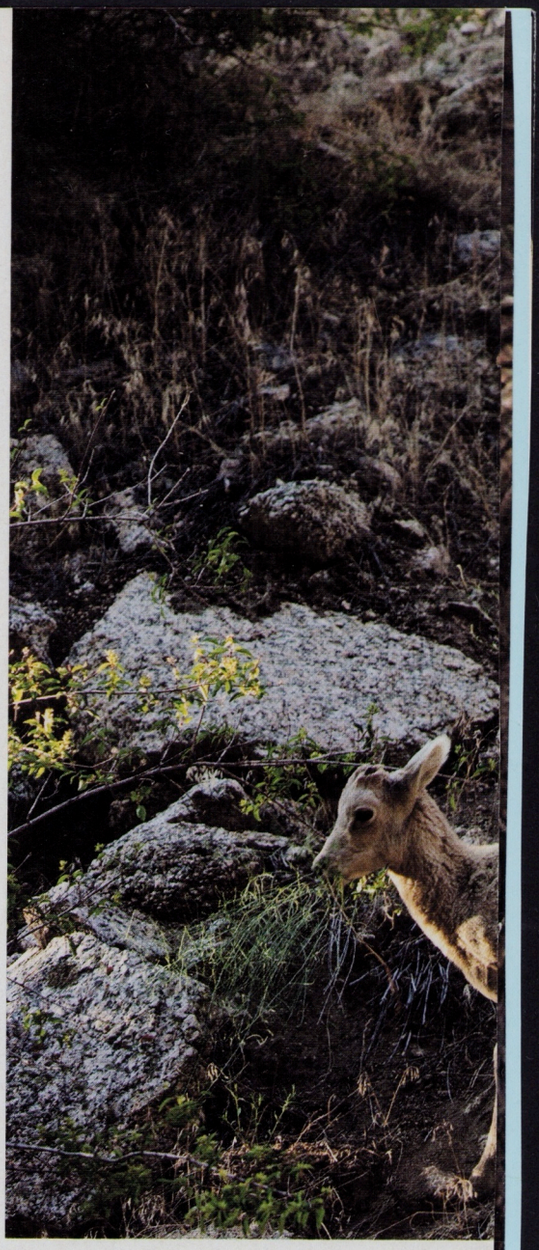
How this decline is progressing at various local sites in the West can be seen in Salmon River Canyon country. The old ram's herd, which has lived among domestic sheep for much of the past century, has dropped 76 percent since the 1980s to only about 100 animals. This decline is unacceptable to several conservation groups and to the Nez Perce Indians, who have treaty rights to bighorns in the Hells and Salmon River Canyons. The wild sheep have long been important culturally to tribal members, who historically turned the animals' curved horns into bows and their thin, tough hides into clothing. "How can the Nez Perce people maintain our culture if we do not have enough bighorn sheep to pass along the skills and knowledge of our forefathers to our sons and daughters?" asked Brooklyn Baptiste, vice-chairman of the Nez Perce.



The issue started coming to a head in 2007 in Payette National Forest, where disease was killing bighorns. The U.S. Forest Service, moving toward a collision with the Idaho Woolgrowers Association and the industry it represents, determined that under its planning regulations, the bighorns took precedence over domestic sheep that ranchers grazed on leased forest lands. "The science is clear that domestic and wild sheep can't live together," says Kevin Hurley, conservation director for the Wild Sheep Foundation, a group of sportsmen who have spent millions of dollars to restore bighorns.

The Nez Perce and NWF sought to address the issue by helping ranchers find new places to put their sheep, but 72-year-old Carlson and other ranchers who leased grassland in Payette refused. "It soon became apparent to us that many sheep operators would rather fight than win," recalls Steve Torbit, executive director of NWF's Rocky Mountain Regional Center in Boulder, Colorado.

That intransigence triggered a series of legal battles. The Western Watersheds Project, the Hells Canyon Preservation Council and the Wilderness Society sued to require the Forest Service to enforce its policy of protecting bighorn habitat. In 2008, U.S. District Judge B. Lynn Winmill ruled that ranchers were barred from grazing sheep in the Payette.



MAP BY THUY SENSER; JUSTIN POEHNELT

A GROUP OF YOUNG bighorns picks its way across a rock-strewn slope along the Salmon River near Shoup, Idaho, in the Salmon-Challis National Forest. Disease transferred from domestic sheep to their wild relatives has killed more than 1,000 bighorn sheep in recent years in more than a dozen herds across the West. A herd in Idaho's Salmon River Canyon has dropped 76 percent since the 1980s to about 100 animals. Nearby Payette National Forest (see map, left) is modifying its grazing rules for domestic sheep to protect bighorns better, but the livestock industry is fighting such measures.

In April 2009 the Idaho Woolgrowers Association responded by pressing the state legislature to require the Idaho Department of Fish and Game to kill bighorns when they came in contact with domestic sheep anywhere in the state. This proposal was a major threat to bighorns. Although federal land agencies such as the Forest Service and BLM have jurisdiction over wildlife habitat on public land, states usually have control over wildlife within their borders.

CHANGING PLANS

Meanwhile, Suzanne Rainville, supervisor of Payette National Forest, was completing a rewrite of the forest management plan in response to appeals by the Nez Perce and by conservation groups that said the plan failed to protect bighorns adequately. Winmill's court decision strengthened the tribe's case and led Rainville to phase out domestic sheep grazing on 70,000 acres of bighorn habitat. When she released her revised plan in 2010, nine ranching and wildlife groups, including the Nez Perce, appealed the plan to the regional forester. Ranchers wanted the new plan overturned, while conservation groups and the tribe wanted it implemented sooner than the Forest Service required. Regional Forester Harv Forsgren upheld Rainville's alternative, and the woolgrowers appealed his

A YOUNG BIGHORN ram bounds across a meadow near the Salmon River in Nez Perce National Forest. The Nez Perce Indian tribe, which holds treaty rights to bighorns in the Salmon River Canyon, has worked to keep domestic sheep off public lands used by bighorns.

ROGER ARCHIBALD

decision to the chief of the Forest Service, Tom Tidwell. His approval of the plan last April sets the stage for further litigation.

"Tidwell's decision is one of the most rigorously scientific decisions I have ever encountered by the Forest Service in my career," Torbit says. "Now it's time for the livestock producers and wildlife folks to roll up their sleeves and work together to find areas suitable for domestic sheep."

Torbit and other bighorn advocates hope they can persuade western sheep ranchers and federal officials to develop a strategy that will allow bighorn sheep populations to expand through conservation and further reintroductions across the West. Colorado—which harbors nearly 7,000 bighorns, among the largest bighorn populations in the West—is seeking to stop a decade-long decline by limiting the spread of disease and using reintroductions. A critical area, Torbit said, is the San Juan Mountains in southwest Colorado, where they need the support of the domestic sheep industry to succeed. Hurley agrees: "We have to turn over every stone to find alternative arrangements for ranchers, or we're going to continue to have conflict."

DISEASE STRIKES

More than 2 million bighorn sheep roamed the American West in the 1800s, experts estimate. By 1906, uncontrolled hunting and the westward push of civilization had reduced bighorn populations to 15,000. More recently, biologists have connected the demise of bighorns to their contact with the millions of disease-carrying domestic sheep that grazed in the Rocky Mountains by the end of the nineteenth century.

With the support of hunters, state wildlife agencies restricted hunting and, in the 1950s, started reintroductions that restored bighorn numbers to as many as 70,000 animals across the West. But as bighorn populations increased, they again came into contact with domestic sheep and their diseases. Wildlife managers blamed the decline on the transmission of *Pasteurella* bacteria, which cause pneumonia in both domestic and wild sheep, though domestic animals are more resistant to the disease.

Although scientists don't know how the disease is transmitted, what factors contribute to transmission and whether transmission of other bacteria, even among wild sheep alone, contributes to the bighorn die-offs, mounting evidence suggests that domestic sheep are

"WE HAVE TO TURN OVER EVERY STONE TO FIND ALTERNATIVE ARRANGEMENTS FOR RANCHERS, OR WE'RE GOING TO CONTINUE TO HAVE CONFLICT."

a major vector. A 2008 study by Colorado Division of Wildlife scientists showed that a single domestic sheep that wandered onto bighorn winter range caused a die-off of more than 86 bighorns from 1997 to 2000.

The old, sick ram that appeared on BLM land in Carlson's area helped convince officials to shut down Carlson's BLM grazing lease shortly after the Payette National Forest closure. He felt forced to call it quits. "Right now if you are a rancher and a bighorn shows up, you're done," says Carlson's attorney, William Myers of Boise. Carlson might have been able to move his sheep operation but, he alleges, doing so would have been costly and would have forced him to move out of an area he loves. Nez Perce tribal wildlife manager Keith Lawrence says that in restricted habitats such as the Salmon River Canyon and Hells Canyon, the best deal for ranchers is either to find new range, as conservationists have urged, or to have the government or other groups buy them out. "If the bighorns recover as we hope they do, they are going to expand," he says.

SEEKING SOLUTIONS

The U.S. domestic sheep industry has been on a steady decline for decades, dropping from a peak of 56 million head in 1942 to 6.2 million in 2007. Lamb prices are up now, however, and the industry is poised to grow, says Margaret Soulen Hinson, president of the American Sheep Industry Association. Hinson's family runs 10,000 sheep from a base ranch near Weiser, Idaho. Some of their range in the Payette is just over the mountain from Carlson's ranch and the Salmon River bighorns.

Hinson worries that the Payette decision will become the basis for federal land policy throughout the West, where 80 percent of domestic sheep range lies and where nearly 4 million sheep graze. In her view, "it would be devastating to the domestic sheep industry," she says.

NWF's Torbit doesn't want to see the sheep industry brought down. "I don't want to start a new range war, because it's not good for anybody, and it's certainly not good for wildlife," he says. He favors a collaborative process that brings ranchers, sportsmen, tribes and conservationists together to protect the range and wildlife but still allows ranchers to thrive.

Hinson says a better understanding of all the stressors that bighorn face and more research on sheep diseases are critical to any collaborative effort. She knows that separation is critical, but like many sheep ranchers she's skeptical that 100 percent separation is possible without putting ranchers out of business. One bright spot in this dilemma is some promising research on a vaccine at Washington State University.

When Idaho Fish and Game biologists finally captured and examined Carlson's wild ram, they found that the bacteria in the bighorn's system were not the same as those documented in Carlson's domestic sheep. No other bighorn deaths were reported. The results that biologists hoped would settle the issue gave neither side solace. Even though it's clear that domestics pass disease to wild bighorn, it's not clear that contact always results in death. In the end, bighorns won the Idaho fight, but the animosity that came from it will make it harder to build common ground.

The Wild Sheep Foundation's Hurley, who managed bighorn sheep for the Wyoming Game and Fish Department for 30 years, is hopeful a westwide solution is possible. He supports a kind of zoning that would give bighorns primacy in some areas and domestic sheep in others. For example, in Wyoming's Shoshone National Forest, next to Yellowstone, conservation groups bought out domestic sheep ranchers to protect the forest's 4,000 bighorns. In other areas, including Bighorn National Forest east of Shoshone, where bighorn numbers are small, domestic sheep take priority.

For Hurley, who found success for bighorns and ranchers in Wyoming, the message is simple: "If you believe in compromise and conservation, both sides have to give up something."

NWF IN ACTION

SEEKING BIGGER BIGHORN NUMBERS

NWF assisted with the funding for the Nez Perce bighorn monitoring program on the Salmon River. NWF is working with tribes and groups in Idaho, Washington and Oregon to persuade the U.S. Forest Service to consider alternate range for ranchers pushed off of the Payette National Forest. Federation regional staff in Colorado and Montana are working with sheepgrowers and other livestock interests throughout the West to reduce conflicts between domestic stock and wildlife, including grizzly bears and bison as well as bighorn sheep. Through its Adopt-a-*Wildlife*-Acre program, NWF has succeeded in retiring more than 550,000 acres of grazing-lease allotments on federal public lands near Yellowstone National Park. In a recent victory, NWF persuaded a rancher near Gardiner, Montana, to stop grazing cattle on 75,000 acres north of the park, offering new habitat to bison that leave Yellowstone in winter. For more information, visit http://wildlifeacre.nwf.org/.

ROCKY BARKER *is the environmental writer for the* Idaho Statesman. *He was awarded NWF's Conservation Achievement Award for communications in 1998.*

LOCAL/STATE

Bighorn sheep face challenges

LIONS THREATEN SPECIES

By TRACIE CONE
Associated Press

YOSEMITE NATIONAL PARK — On the easternmost edge of this expanse of glacial granite, far from tourist haunts, a tiny lamb rams his mother's udder then flutters its tail when milk starts to flow.

California biologists watching through spotting scopes take note, for this is no ordinary baby and this treacherous sheet of talus rock at 8,000-feet elevation is not particularly safe, even for a creature as sure-footed as his mother.

On this day, they'll count him as part of the precarious population of Sierra-Nevada Bighorn Sheep, at 400 one of the most endangered big mammals in the U.S. But they know the odds are 75 percent against this little guy reaching adulthood: rockslides, avalanches, disease and mountain lions all stand in the way.

"This was a harsh winter and we've been anxious to see how they'd do," said Thomas Stephenson, the senior environmental scientist with the Sierra Nevada Bighorn Sheep Recovery Program from his perch in Lundy Canyon in the eastern Sierra Nevada.

For a decade, California and federal biologists have helped the species by removing the obstacles they could: disease-carrying domestic sheep were banned from bighorn sheep territory two years ago and trappers hunted, snared and collared mountain lions suspected of being a threat.

But saving bighorn sheep by harming mountain lions is creating new controversy within the sheep recovery project and it pits an endangered species against one that received special protections by California voters in 1990.

DEPARTMENT OF FISH AND GAME/AP

A pair of bighorn sheep move across Wheeler Ridge in the Sierra Nevada near Rovana.

Late last year, one of the four program biologists filed a formal complaint about an increase in mountain lion hunting since 2007 prompted by a spike in sheep deaths. It resulted in tense office discussions and, eventually, a ruling favorable to lions this winter from the state Legislative Counsel.

"We have to look at the whole ecosystem and not treat the sheep like they're in a captive breeding program," said Becky Pierce, the associate wildlife biologist and cougar expert who filed the complaint.

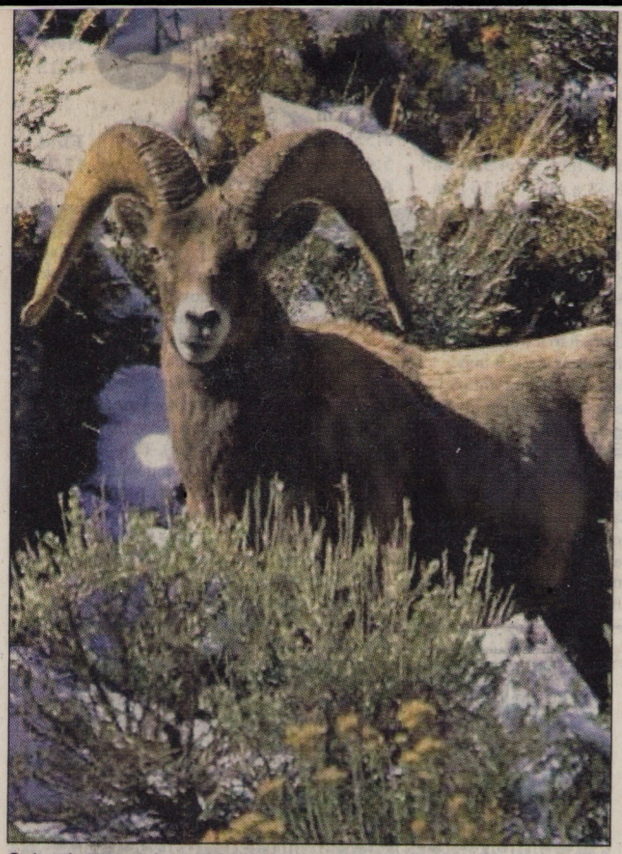
A lion proven to kill endangered bighorns can be shot. But the ruling now forbids snaring to collar a lion to track its movements or even capture a killer.

"It's so easy to say, 'we'll just take out as many as we can in their range' when the bigger issue" — getting sheep to live alongside their main predator — "will ultimately provide the most benefit," said Stephanie Boyles, wildlife scientist with the Humane Society of the United States.

"It's a good question for a college class," said Stephenson, of the California Department of Fish and Game. "Ask them if it's OK to kill mountain lions and they'll say 'no.' But ask them if it's the only way to preserve the species and get them back into Yosemite National Park and their other historic ranges, and they might say 'yes.'"

Sierra Nevada Bighorn Sheep, with horns that splay sideways, are related to the classic desert bighorns whose circular horns are like the icons on Dodge trucks and Rams football helmets. There never were very many — maybe 1,000 scattered since prehistoric times in a dozen herds across the alpine eastern Sierra.

But settlers brought guns and, worse, domestic sheep and the numbers quickly dwindled. By 1999, when Sierra Nevada Bighorn Sheep were federally listed as endangered, they numbered 114. Today, due to intensive management, there are 400 in eight of the 12 remote areas optimum for their long-term survival, two-thirds of the program's population goal.



Scientists say domestic sheep can pass deadly diseases on to the protected Sierra Nevada Bighorn Sheep, prompting local land managers to close sections of public lands to sheep herds, despite the impact on local ranchers. Photo courtesy Mammoth Times

The battle over the bighorn

Mono residents bring concerns over protection of sheep to county supervisors

By Wendilyn Grasseschi 11-24-2012
Mammoth Times Staff Writer

One hundred years ago, the fleet-footed Sierra Nevada bighorn sheep kept time to the mountains, moving upslope to summer pastures in the spring, down slope to winter ranges in the fall when blizzards beset the high Sierra.

They roamed between Olancha and Bridgeport, walking knife-edged ridges, dodging mountain lions and avalanches, sleeping under a thick, warm blanket of snow when temperatures plummeted to 10 below.

Then, in the course of a half century, they almost disappeared, knocked from their high and lofty perches by disease, habitat loss and other factors scientists are still trying to understand.

By 1999, there were just 100 of the sheep left in the world. Their closest relatives, the Desert bighorn of the Great Basin country and the Rocky Mountain bighorn, were separated by huge swathes of land, making interbreeding impossible.

The Sierra bighorn was headed for extinction. But a last minute push to save the sheep took hold and they landed in the middle of the federal Endangered Species list, a designation that funnels money and resources into recovery plans for those on the list.

Today, there are about 400 sheep roaming the wild canyons and ridges along the crest of the Sierra and scientists believe they could well make it off the list within the decade.

But along the way, the fierce efforts to save the sheep have taken prisoners, tearing into an old way of life and leaving some of Mono County's few remaining domestic sheep herders struggling to survive.

The problem, scientists say, is domestic sheep can pass down deadly diseases to the Sierra bighorn. To solve this, domestic sheep grazers had been forced to give up grazing on allotment after allotment up and down the Sierra.

The impact has been especially profound in Northern Mono County where the wild, rolling hills once supported huge herds of domestic sheep until federal land managers closed certain ranges to grazing. It was a final straw for many ranchers, already beset by a modern world intent on moving on without them.

So last Tuesday, when Fish and Wildlife Service biologist Dr. Tom Stephenson was in Bridgeport to update the county supervisors about the bighorn's status, he was expecting controversy.

"We don't want to hurt the bighorn, but we want to stay in business," said Marianne Leinassar, a rancher with FIM Corporation who runs domestic sheep near the Conway Summit area.

She was especially frustrated with Stephenson's worries about some of her grazing allotments, which he said were pushing up against – or in – prime bighorn territory.

"I want to stay in business, for me, for my son," she said. "And we are out there every day. We know that land, we always account for every sheep, we better the resource, and we have never seen one bighorn out there.

"It's always the 'potential of risk,' it's always what 'might happen,'" she said with clear frustration. "But to make a sweeping statement that we have a risk (of transmitting diseases between domestic sheep and bighorn), I haven't seen any proof of it. How many years do I have to say I'm protecting the resource? Why can't I say I'm protecting the property?"

Tim Hansen, North County's District 4 supervisor, who has been advocating on behalf of the remaining domestic sheep grazers in his district since he took office two years ago, echoed her frustration.

"They have already given up Bloody Canyon and Tamarack Peak, Tamarack Canyon, and Dunderberg Peak," he said. "We've got a Rover on Mars and no one can prove who's carrying the disease – and we've got a livelihood and a culture that's being trashed."

"If you lose a band, you can lose a paycheck for the year," said George Milovich, the Mono and Inyo County agricultural commissioner, quoting lamb prices.

Stephenson said the science supporting the transmission of deadly respiratory diseases is strong, and he urged the county supervisors to support actions that would protect the Conway area for the bighorn. He stopped short of saying all domestic sheep needed to be removed, an opening that some county supervisors were quick to jump on.

"I think we should pursue your idea of fencing the area," said Supervisor Larry Johnston to Stephenson, seeking a pragmatic solution. Other options might be to rotate grazing times for the domestic sheep so they are not on the property when bighorn rams are in rut and traveling, Stephenson said.

All possible options should be pursued, Johnston and other supervisors said, noting that the Conway Ranch area was owned by the county and operated under a policy that includes protecting "traditional ways of life" – including sheep herding – on the Conway Ranch area. But Hansen, who leaves office at the end of the year, didn't seem reassured.

"Maybe we cannot wait for 12 years to have another meeting on this," he said.

In 1995 the population of the Sierra Nevada Bighorn Sheep hit an all time low of 100 individuals despite efforts by the California Department of Fish and Wildlife (CDFW) to reestablish bighorn herds in historic habitat. The decline of this naturally gregarious animal was due to centuries of unregulated hunting and disease outbreak brought about by transmission of virulent disease carried by domestic sheep. The worst of which was pneumonia from the bacteria Pasteurella in 1870.

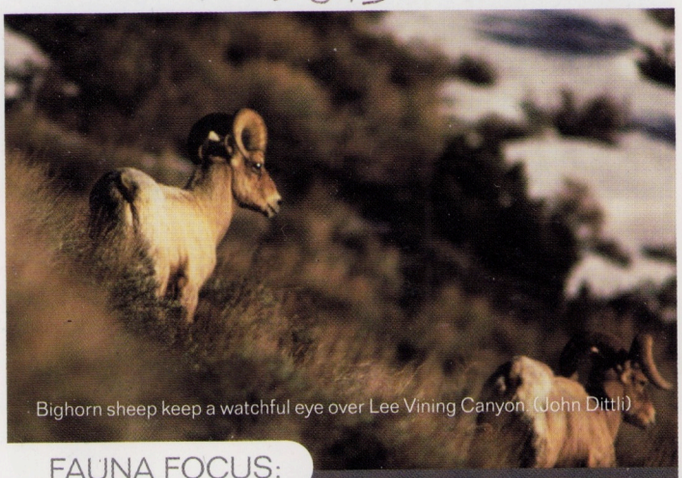
In 1999 the CDFW implemented a program for the recovery of this threatened subspecies and in 2000 the Sierra Nevada Bighorn Sheep was listed as a federally endangered subspecies. Today about 500 animals remain in the wild and efforts continue to protect and grow populations with the goal of having the species downgraded to the status of threatened.

The current population is made up of four recovery and herd units. The ranges of these herds cover an area of the Sierra Nevada from west of Bridgeport to west of Olancha.

Recently, Big Horn sheep in the Sierra Nevada are getting a lift from the California Department of Fish and Wildlife. They're helping bighorn sheep by transporting them into open territory - via helicopter. Biologists are taking wild sheep, mostly pregnant ewes, from healthy herds and starting or augment other herds. On their own, the sheep have great difficulty moving through areas where they might be attacked by mountin lions. Helicopters provide them with safe passage to new feeding grounds, and it's working - the population was down to as few as 100 individuals. Now it has increased to about 600, half its estimated historic level.

Habitat of the Sierra Nevada Bighorn Sheep occurs on the eastern slopes of the range from as low as 4,700' to as high as 14,000'. The animals prefer open areas with high visibility characterized by steep slopes and sparsely vegetated rocky outcrops. Mountain lions are a natural predator and the sheep rely on eyesight and their ability to reach high rocky perches quickly to escape predation.

2013



Bighorn sheep keep a watchful eye over Lee Vining Canyon. (John Dittli)

FAUNA FOCUS:

The wild sheep ranks highest among the animal mountaineers of the Sierra. Possessed of keen sight and scent, and strong limbs, he dwells secure amid the loftiest summits, leaping unscathed from crag to crag, up and down the fronts of giddy precipices, crossing foaming torrents and slopes of frozen snow, exposed to the wildest storms, yet maintaining a brave, warm life, and developing from generation to generation in perfect strength and beauty.

–John Muir, "The Mountains of California"

The rocky, alpine habitat of the new southern additions to the Hoover Wilderness near Lee Vining Canyon supports a herd of reintroduced Sierra Nevada bighorn sheep, an endangered species. In the 1990s, the Sierra Nevada bighorn sheep population neared extinction—only 100 or so animals survived. Thanks to the work of wildlife ecologist Dr. John Wehausen, the Sierra Nevada Bighorn Sheep Foundation, the U.S. Fish and Wildlife Service and the California Department of Fish and Game, their numbers are on the rise again. These "animal mountaineers" can be spotted by a patient eye in many of the Eastern Sierra's highest (and newest) wilderness reaches, including the Hoover, John Muir (near Pine Creek Canyon) and White Mountains Wilderness areas.

NewsBank inc. America's Newspapers

Paper: San Francisco Chronicle (CA)
Title: Staring down bighorns in Inyo
Date: May 6, 2007

From a towering rock monolith 150 feet above us, four Sierra bighorn sheep stared down. We homed in with binoculars and a spotting scope.

At the lip of the monolith, a big female perched like a hood ornament. When I zoomed in closer, its gaze seemed locked with mine, and it stayed like this for five minutes. Three other young bighorns, who appeared to be yearlings, were within 10 feet, also watching. Their horns were more spikes than full curls.

The air was so still and quiet that you could hear a single rock tumble down the canyon. And yet the bighorns were able to pick their way from the monolith and up through a steep field of rubble without displacing a single pebble. They reached a bush that was just leafing out with fresh greenery and then nibbled for a half hour, ignoring us.

Most people have never seen a Sierra bighorn. But in the canyons near Bishop in Inyo County, anybody can take part in this rare opportunity, a world-class wildlife adventure. In a day of driving, scanning and a bit of hiking this past week, we spotted four bighorns up Silver Canyon in the foothills of White Mountain just east of Bishop, and 10 more up Pine Creek Canyon in the east slopes of the Sierra Nevada just northwest of Bishop.

In 1995, the population of Sierra bighorns was down to about 100, so close to extinction that some lobbied to capture all the remaining bighorns for a captive breeding program. Instead, the population has rebounded to 400-plus.

Our trip started in Bishop in the **Owens Valley**, where we met the state's bighorn guru, John Wehausen. As an independent contractor/scientist for the Department of Fish and Game, Wehausen has spent 33 years tracking the Sierra bighorn in a quest to protect and expand the herd. Wehausen tracks herd numbers and migration with telemetry collars, has transplanted and established new herds, and stays on top of the two biggest threats to the Sierra bighorn: mountain lion kills and disease contracted when the bighorns mix with domestic sheep.

"In 1995, the total populations got down to about 100 and some were thinking of captive breeding, because things were getting that desperate," Wehausen said. "Selective lion control has certainly benefited the Sierra bighorn. The lions' population hit a low in the late '90s and the sheep population took off. There's a great concern right now because the lion population is back up. People are wondering if we're being adequately effective (in killing problem lions).

"Another thing is that we had years of good rainfall." That provided high survival rates of lambs, he explained, because increased forage raised the carrying capacity of the stark high Sierra landscape.

Near Bishop, the Pine Creek herd has 115 animals and the Silver Canyon herd, which Wehausen started with a transplant, is up to 39 animals. In the next month, Wehausen projects that 30 to 35 lambs will be born.

Sighting the bighorns is accessible to anyone with a vehicle. The road up Pine Creek is paved. The road up Silver Canyon requires a vehicle with high clearance and a few fords of a little creek. The trip to either destination, Pine Creek Canyon or Silver Canyon, can be extended deep into the mountains on 4-wheel-drive roads, but that isn't necessary.

In fact, the hardest part of the trip isn't locating the bighorn range. It's picking out the animals from the canyon walls. The untrained eye will not see the animals at first because they seem blend in perfectly with the landscape. That's nature's way to try to protect them from mountain lions. If you rush, or don't scan correctly, you can be 250 feet from a herd and not see them.

We started our trip by driving up Pine Creek, a gorgeous stark canyon that rises in the eastern Sierra from U.S. 395. At about 8,000 feet, we parked in a pull-out near where the road crossed Pine Creek, at the foot of an old mine.

We scanned the south side of the canyon wall. A wide scan of the canyon revealed nothing. It not only seemed there were no sheep, but not a single living thing, just rock. But close-up analysis revealed vegetation was sprouting in crevices between the rocks.

I've always closely followed the arrival of spring, as it rises in elevation from sea level to the Sierra crest, to locate the best places to see wildlife, wildflowers and catch fish. Wehausen has refined the process to scientific precision.

"I've measured that spring moves up in elevation 60 feet per day," he said. "I've climbed the slopes and measured it."

That is the first key in finding the Sierra bighorn: find high-mountain terrain where spring is just arriving.

That is what led us up Pine Creek to 8,000 feet. The second key is learning how to look for wildlife. Simply scanning across the slopes can be ineffective. You are better off looking for sheep the way pilots look for other airplanes in the air, where you identify a small section of land (or air) and then search that section. You then move on to another section until the search is complete.

It also helps if you have a grasp of Sierra geology. Sierra bighorn are attracted to metamorphic rock habitat because it gives rise to more vegetation, compared to low-productive granite- and limestone-base landscapes. This can be critical because bighorn sheep almost never drink water. They get water from the plants they eat. That's how they survive on the towering crags of high mountains.

About midway up the canyon, Wehausen caught a glimpse of movement. Up went the binoculars. "There they are!" First it seemed there were four, all browsing, amid boulders, scree and a few scraggly Jeffrey pines. A closer look suddenly revealed another four just a bit higher on the slope, also nibbling. Then two more appeared, 100 yards above them.

In a matter of minutes, scanning the canyon wall transformed the experience from taking in a pretty view to a wildlife spectacle. We watched them for an hour from different spots.

The Sierra bighorns will stay in Pine Creek Canyon in May, with many lambs being born. As the arrival of spring moves up the slope, the bighorns will move with it. In contrast, the Silver Canyon herd spends all summer on the other side of the **Owens Valley** in the foothills of White Mountain.

Anybody who cruises U.S. 395 in the Easter Sierra has a world-class wildlife adventure within reach. ----------

If you go

Cost: Access is free.

Map: For a map of Inyo National Forest, order with credit card at fs.fed.us/recreation/nationalforeststore or in person at Inyo National Forest office in Bishop, (760) 873-2400.

Wildlife ethic: Never get so close that your presence changes the behavior of wildlife in any way. Bring binoculars or spotting scope.

Pine Creek Canyon: From Bishop, take U.S. 395 north for 10 miles to Pine Creek Road. Turn left (west) and drive nine miles to creek crossing and park on left and scan for bighorns. Drivers with 4-wheel-drive vehicles can continue up narrow/rocky road to (road eventually leads over ridge and down to next canyon to the north and Rock Creek).

Silver Canyon: From Bishop, take Main Street/U.S. 395 north for one mile to junction with Highway 6. Turn east and drive 4 miles to Silver Canyon Road. Turn right and drive up canyon five to seven miles and scan for bighorns. High-clear vehicles with good traction required for creek crossings. Drivers with 4-wheel-drive vehicles can continue (becomes twisty and steep) to White Mountain Road.

Bishop lodging: La Quinta, (760)873-6380 or lq.com; Best Western Creekside Inn, (800) 273-3550 or www.bishopcreekside.com; others at Bishop Visitors Bureau, (760) 873-8405 or www.bishopvisitor.com.

Information: Department of Fish and Game, dfg.ca.gov.

Caption:
A bighorn sheep makes his way up a steep hillside on Wheeler Ridge in the Eastern Sierra. The population has rebounded to 400-plus in recent years.

Al Seib

Los Angeles Times

Caption:
PHOTO

(c) San Francisco Chronicle 2007

Author: Tom Stienstra
Section: SPORTS
Page: C13
Column: OUTDOORS
(c) San Francisco Chronicle 2007

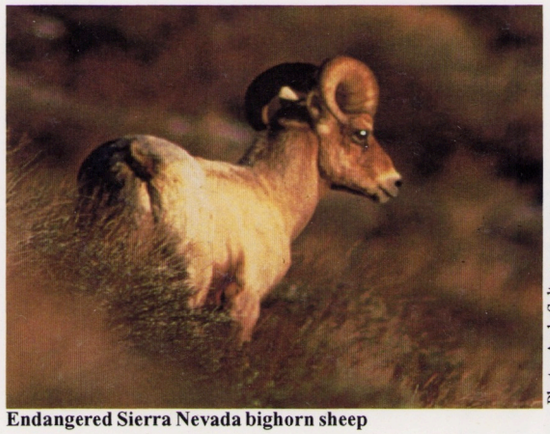


Photo: Andy Selters

Endangered Sierra Nevada bighorn sheep

A different sort of sheep man

by Ken Birchim

John Wehausen studies the bighorn sheep populations in the Sierra and White mountain ranges. His research was the ground work for a program to reintroduce the Sierra bighorn sheep to areas from which they had disappeared.

Wehausen first became interested in the sheep in the early 1970s while a graduate student studying wildlife management at U.C. Davis. About the same time, Dave Dunaway, then a wildlife biologist with the Inyo National Forest in Bishop, became alarmed at what he felt was a drastic decline in bighorns located in the Sierra Nevada Range. He suggested that human disturbance was the major factor, but it was obvious that a comprehensive study was necessary to fully understand the situation. Wehausen came to the Valley to undertake such a study.

"I set up a base camp near the herd on Mt. Baxter to study the dynamics of the population," he explained. "I wanted to know how many animals there were and what the populations were doing, to see if anything was changing and if so in what way and why. This is the fundamental information needed for all wildlife management studies. But sadly, most wildlife management studies do not incorporate this fundamental understanding.

'All of my observations have to be turned into numbers and graphs to test by hypotheses. I have sat for as long as eight hours staring through my spotting scope to arrive at a single dot on a graph.'

"In my studies of the sheep populations, I take a purely scientific approach. All of my observations have to be turned into numbers and graphs to test by hypotheses. I have sat for as long as eight hours staring through my spotting scope to arrive at a single dot on a graph."

Wehausen continued his study for four years, working from the camp for as long as thirty days at a time. "I once snow-shoed up Sawmill canyon and across the crest in the middle of winter after hearing of a siting of bighorns. And I didn't locate the herd," he said.

However, Wehausen did find evidence that may refute Dunaway's theory. "I discovered that the sheep populations near Mt. Baxter were actually increasing," he said. "I counted 220 sheep in that location in 1978, a marked increase from previous years."

Furthermore, Wehausen said, it became apparent that the Mt. Baxter herd could serve as stock to reintroduce bighorns into the areas where they are now extinct. If it were possible to accomplish this, Wehausen theorized back in 1978, it would definitely minimize the chance of total extinction of the Sierra bighorns.

Wehausen distributed this information to interested government agencies, suggesting the reintroduction program. There had been no trapping and reintroduction of the Sierra bighorns in California prior to this. The only previous attempt was made with a herd of Canadian bighorns brought in from British Columbia, Wehausen said. They were located in Lava Bed National Monument. They all died of pnuemonia in 1980.

Bighorn sheep in the Sierra Nevada are listed as rare in California, and a condition of that classification dictates that an attempt should be made to expand the overall populations. This helped to enable establishment of a reintroduction program. "The political climate was right in order to move ahead with the project," Wehausen said.

Wehausen entered into a verbal agreement with Dick Weaver, a wildlife manager for the Department of Fish and Game in Sacramento. Weaver agreed to organize and fund the capture if Wehausen would find the appropriate sites for release and help with Forest Service paper work. "Dick is a man who's been involved with the bighorn sheep since before I was born," Wehausen added.

They decided to trap the animals with a method used to capture sheep in Colorado: a net is suspended on poles above the ground with a bait of alfalfa, fermented apple pulp and salt placed underneath. When the animals are attracted to the bait, the net is released entangling the sheep.

"First of all, they have to get 'hooked' on the bait so that they will congregate under the net. In our first attempt, in 1978, the capture failed because the sheep were not sufficiently hooked on the bait. But, we finally succeeded in 1979. We were able to capture nine sheep."

The captured sheep were collared with radio transmitters (used to track the animals) and transported to Pine Creek Canyon in the Sierra to be released. "From having studied the habitats of the sheep, I concluded that this would be an ideal location," Wehausen said. "To date 49 sheep have been relocated in Pine Creek Canyon, Wheeler Crest and Mt. Langley areas, thanks to the efforts of the Fish and Game Department and their improved capture methods. The animals are now herded by helicopter into nets and airlifted to their new locations. It is much cheaper, more effective and less time consuming.

"I feel the program is a success," Wehausen commented. "I counted a minimum of 31 sheep in the Wheeler Crest area alone. Unfortunately three sheep were lost to an avalanche there in 1980. Had they survived I'm sure the count would have been much higher.

"Due to the relocation program we now have four distinct and separate herds in the Sierra. I feel that the possibility of extinction of the Sierra

OVER

bighorn is now reduced."

Wehausen is presently working to relocate a new population of bighorns in Lee Vining Canyon, with the hope they can once again establish a herd in Yosemite National Park. The major obstacle to this reintroduction is the presence of domestic sheep grazing in the canyon, because of possible transference of diseases they carry. Such diseases probably contributed to the epidemic that killed the bighorn sheep at Lava Bed National Monument. "If this project is abandoned, it will be because of the presence of the domestic sheep in the canyon," he said.

'If private sources can't supply the money, I will have to stop working in this area.'

Wehausen continues to gather information that fuels the reintroduction program, having expanded his studies to include sheep that inhabit the White and Inyo mountain ranges. All his work is on contract basis, funded by the National Park Service and the Inyo National Forest, but due to cutbacks in federal funds, money allocated to such programs has all but ceased. "If private sources can't supply the needed money, I will have to stop working in this area," he sadly concluded.

The reintroduction program is not the only reason for Wehausen's study although it is a beneficial result of it. "There are so many fundamental questions to yet be answered about bighorn sheep that I would like to continue to study."

Among the many projects Wehausen is presently engaged in is a study concerning the impact mountain lions have on local bighorn herds. "I can't say for sure to what extent the lions are impacting these herds, because I haven't compiled all the data yet. But they do appear to play an important role in the overall ecology of the population," he said.

Man as a predator does not appear to be a significant factor. Though he does not rule this out entirely, it seems that responsible hunters do respect the plight of these animals and agree that they should be protected, Wehausen explained. Apparently the major factors in the mortality rate are nutrition and disease.

Most rams only live to be about eight years of age. This is due, in large part, to the animals literally beating themselves to death during the rutting season. "They just burn themselves out. During this season I can easily locate the herd by listening for the sounds of them pounding their heads together. This type of activity can not go on year after year without taking its toll," Wehausen explained.

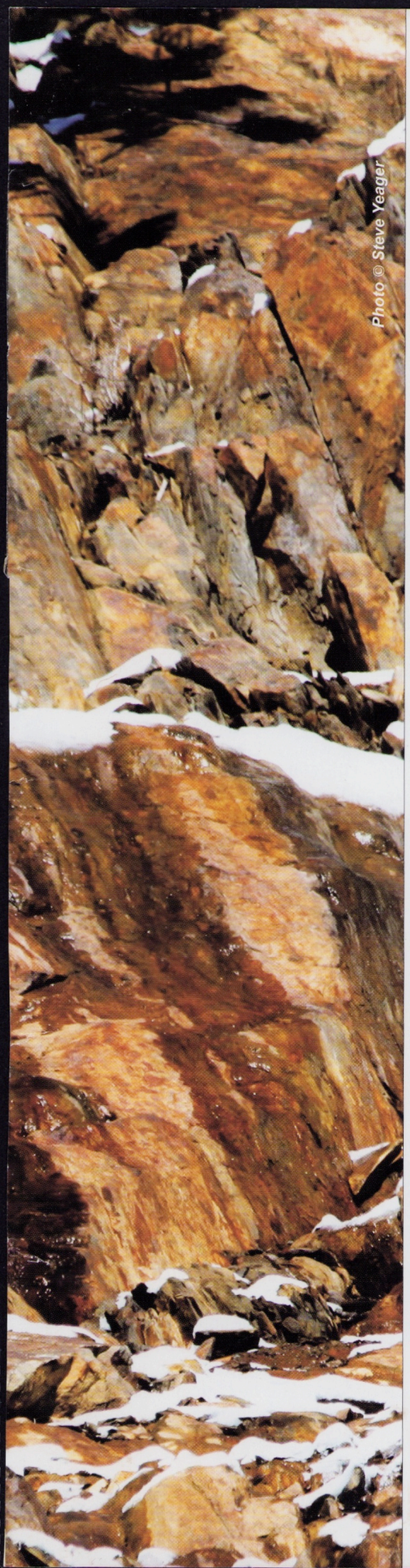
One problem he has encountered is how to determine growth rates of individual sheep within the populations. He is working on the idea of measuring the size of a lamb's ears in relationship to the size of its horns. "I can do this from photos and hope to arrive at a somewhat more accurate system," he said.

It is a simple matter to find the age of a ram. Wehausen says a new section of horn is formed each year with a dark ring. By counting the rings, ages can be determined. Ewes pose the most difficult problem: "During the gestation and lactation period the nutrients that would otherwise by used to form her horns are bing used to supply the nutritional needs of the lamb. So the age rings present in her horns are less apparent than in those of the ram. They only sure way is to take a cross section of a tooth."

Wehausen has found the Sierra bighorn sheep migration is not entirely determined by snow depth. While in winter sheep may be driven down to the lower slopes by snow, in spring as the snow melts, the sheep meander up the slopes for greener foliage. Plants sprout at a continuous rate up the sides of the mountain as it gets warmer. By plotting a graph of plants as they sprouted Wehausen found that the migration followed this exactly. "I concluded the sheep merely travel up the slopes as the new plants become available."

After expanding his studies to include the sheep located in the Inyo and White ranges, Wehausen discovered discernable differences from Sierra based populations. "The sheep in the Whites appear to grow more rapidly. They are not larger than other adults, but simply attain that size sooner. I believe the difference in their growth is due to diets, particularly mineral content of the plants."

Much of Wehausen's time at present is being spent drafting proposals to private agencies in an effort to obtain grants to carry on his work, not only to benefit the future of the Sierra bighorns, but the future of the Owens Valley as a natural wildlife habitat.



Story by **Gigi de Jong**

Future no longer on the edge for three endemic and endangered species from the Eastern Sierra's Owens Valley

Threshold of Recovery

The story of how humans have had a nearly catastrophic impact on an environment followed by a coordinated intervention to prevent the cataclysmic results is a far too common theme within the field of wildlife conservation. It happens at worldwide levels all the way down through national environmental issues and down further to regions within California. Three fortuitous species endemic to the eastern Sierra's Owens Valley continue to survive thanks to timely action by numerous organizations during recent decades.

The Sierra Nevada bighorn sheep, the Owens pupfish and the Owens Valley checkerbloom remain listed as endangered species, but their continued existence is no longer in serious peril. Recovery programs spearheaded by environmental scientists from the California Department of Fish and Wildlife, in association with other agencies and individuals, are achieving stated goals and ongoing success.

Spread out along the eastern side of the Sierra Nevada, the Owens Valley appears as an expanse where time has stood still. The vast landscape measuring 100 miles long and between 6 to 18 miles wide remains one of the least populated in the country. The valley covers about 3,330 square miles and carries a population density of 5.25 people per square mile, according to the U.S. Census Bureau. Ranked by population density with other states, the valley falls somewhere between Wyoming's wide open range with six people per square mile and the nation's northernmost state, Alaska, with just 1.3 people per square mile.

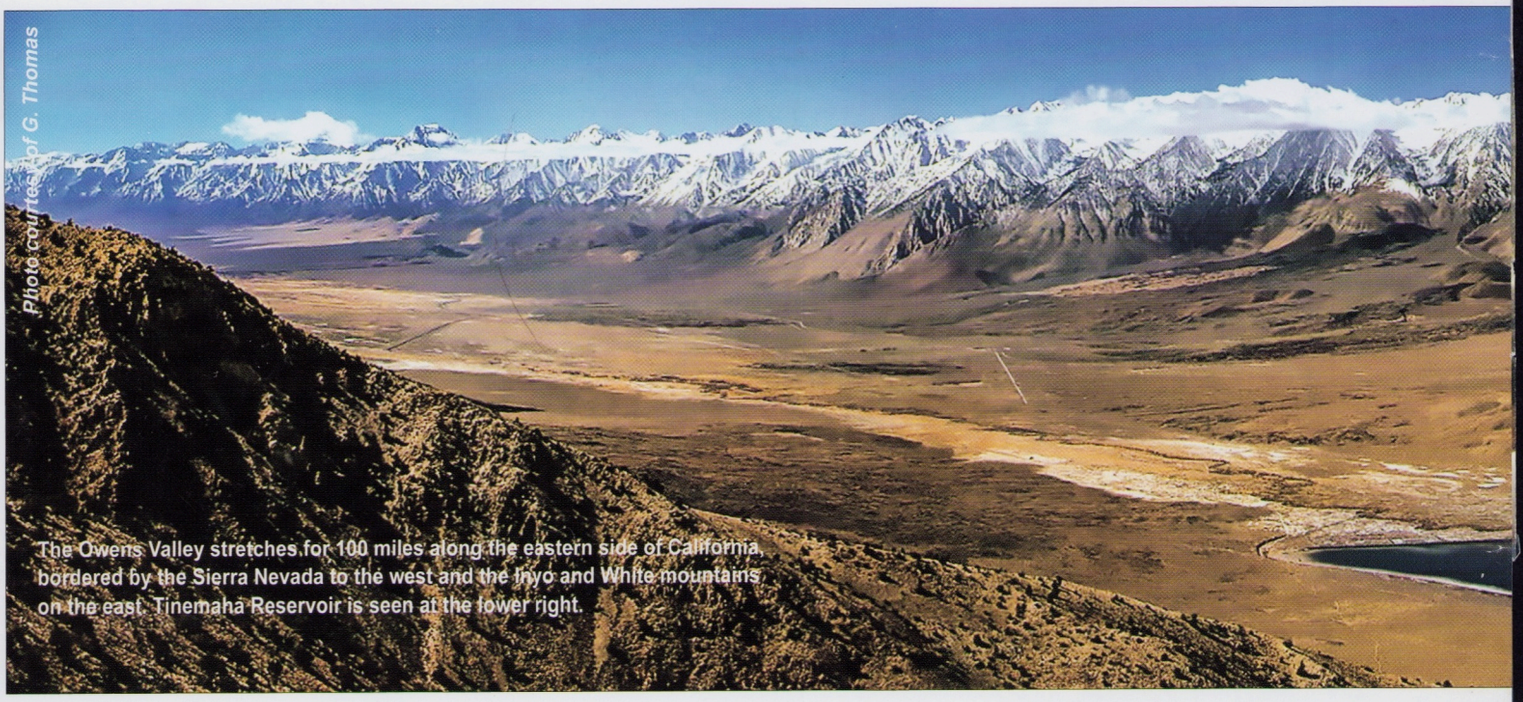


Photo courtesy of G. Thomas

The Owens Valley stretches for 100 miles along the eastern side of California, bordered by the Sierra Nevada to the west and the Inyo and White mountains on the east. Tinemaha Reservoir is seen at the lower right.

Photo © Steve Yeager

The Sierra Nevada Bighorn Sheep Recovery Program involves both state and federal wildlife organizations and seeks to sustain growth, extend the distance between herds to minimize natural catastrophic impacts on their populations and prevent contact with domestic sheep and goats in order to stem the spread of communicable disease.

The valley floor rises about 4,000 feet above sea level, flanked by the Sierra Nevada to the west and the White and Inyo mountains to the east. Steep granite peaks rise dramatically on both sides with the crests reaching more than 14,000 feet. Geologists consider the Owens Valley one of the deepest valleys in the United States.

Highway 395 dissects a north and south thread through substantial plains of uncultivated lands that appear untainted by human interference. The towns are small, few and far between. With such a quiet bucolic appearance, the valley appears capable of maintaining the equilibrium of its natural environment. Unfortunately, this is not the case, and the consequences of human activity have had far-reaching effects.

Early settlers came in search of wealth they thought would come through a boom in mining or fertile lands for homesteads. They brought with them non-native plants and animals that impacted the sustainability of native species. An even more significant impact to the area came from the export of water to the bulging Los Angeles area. The shift in water rights drained the underground aquifer and created serious consequences for the native plants and animals of the Owens Valley.

SIERRA NEVADA BIGHORN SHEEP

Many wildlife biologists and scientists who work on the conservation of Sierra Nevada bighorn sheep (*Ovis canadensis sierrae)* believe the species has roamed the Sierra Nevada for more than 300,000 years. Because of the gradual deterioration of

populations, a decade ago CDFW scientists began a recovery program for the critically endangered species. Today, scientists review the work that has been expended and feel secure in calling the effort a success.

One of those involved with the species is senior environmental scientist Tom Stephenson, a wildlife supervisor for the northern portion of CDFW's Inland Deserts Region and the program leader for the recovery program. While it is impossible to know how many sheep traveled across the high mountains in prehistoric times, Stephenson knows the population numbers were thriving in the mid-19th century, when human habitation in the Eastern Sierra was increasing and encounters with these animals were frequent. As late as 1870, evidence suggested that at least 1,000 animals across a number of healthy herds inhabited a huge swath of the high Sierra, from Sonora Pass south to Olancha Peak.

That healthy state of affairs for the bighorn reversed over the next 100 years as the population was almost wiped out. Unregulated hunting of this gregarious animal and the rampant spread of disease carried by domestic sheep brought this species to the brink of extinction. The worst of the illnesses came through the transmission of pneumonia in the late 1800s, and by 1970 only two small herds had survived, one in the vicinity of Mount Baxter and the other near Mount Williamson.

Despite efforts by CDFW to reestablish bighorn herds in other historic habitats, the total population of the Sierra Nevada bighorn sheep continued to decline. In 1995, it hit a low of 105 individuals. The U. S. Fish and Wildlife Service listed the animal as endangered under the Endangered Species Act. That same year, California upgraded its listing from threatened to endangered under the California Endangered Species Act.

A structured recovery effort was implemented under the joint leadership of both state and federal fish and wildlife organizations. The Sierra Nevada Bighorn Sheep Recovery Program formed through a collaboration with the National Park Service, Bureau of Land Management, U. S. Forest Service and the USDA Wildlife Services. The program established three measurable goals:

- Ensure at least 305 females are among the herds to ensure sustainable growth.
- A dozen viable herds must be distributed within specific areas in historic ranges, known as herd units, in order to minimize any natural catastrophic impact on the population as a whole.
- Prevent contact between bighorn sheep and domestic sheep and goats to stem the spread of communicable diseases.

When the objectives are met, the species can be downlisted from an endangered to a threatened status on the ESA lists. Stephenson said the species had grown close to the goals required until the past year. The winter brought record snowfall to the Sierra Nevada and the severity of the extreme conditions resulted in fatalities among the herds.

"It knocked some of the populations back by about 20 percent, but all the populations persisted," Stephenson said. "Healthy populations can bounce back, which is why it is imperative that contact with domestic sheep and goats is all but eliminated if this species is to survive and thrive."

He believes it fortunate that the harsh winter occurred prior to any decision on a shift for the species from endangered to threatened. It tested the basis on which the goals of the recovery program were set and provided justification.

Still, even with the winter's setback, the recovery program has reached two of the goals. Head counts indicate that viable herds do occupy the specified herd units that had been indicated. The second met goal came as a victory in the Legislature earlier this year after a county board of supervisors rejected a request to renew a grazing lease for domestic sheep.

The decision by the Mono County Board of Supervisors came after presentations from CDFW and the U.S. Fish and Wildlife Service that presented scientific evidence of the damage caused by the grazing habits of domestic sheep within a mile of habitat for the endangered Sierra Nevada bighorn sheep. The presentations and decision by the Mono County supervisors drew praise from allies, such as the Sierra Nevada Bighorn Sheep Foundation.

Stephenson cautioned against any suggestion that the bighorn sheep population has returned to its former glory. Other factors like predation by mountain lions or natural disasters from avalanches to limited food sources can contribute to declines in populations. "These do pose a threat by virtue of the fact that herds are relatively small and the loss of just a few animals can potentially be significant."

But such potential pressures pale in

Above, Owens pupfish populations suffered as non-native fish were introduced to the local waters for use as bait. Soon, the non-native trout, largemouth bass and bullfrogs were thriving, and using the Owens pupfish as their food source. By 1940, most people thought the pupfish was extinct, but in 1972, three scientists discovered a small pocket that had survived. Next page, known by its five-petal pinkish-purple bloom, the Owens Valley checkerbloom is found only in the valley's greater alkali meadow environment. In 1979 it was listed as an endangered species under the California Endangered Species Act.

comparison to what would happen to populations if a virulent disease moved through a herd. An event like that, experts agreed, would likely annihilate the bighorn population. The risk of such an event highlights the importance of the preventive decision made by Mono County supervisors.

Today, members of the recovery program labor in the bitter winter and broiling summer of the high Sierra to conduct population surveys of all bighorn herds. They determine the nutritional status of more than 200 bighorn sheep as well as monitor the survival and habitat-use patterns of the animals. They collect data stored on more than 45 global positioning system collars as the collars fall from the animals. They also draw from a 40-year-old study that started with the earliest recovery efforts. The feeling is that when they analyze the decades-old study next to the newest information from the field, it enhances the overall depth of information they have on wild sheep, something more valuable as it reveals details about their habits and habitats.

Today more than 600 animals live in these mountains with herds covering an area larger than 1,500 square miles from west of Bridgeport to west of Olancha.

Habitat occurs on the eastern slopes of the range from as low as 4,700 feet in elevation to as high as 14,000 feet. The animals prefer open areas with high visibility characterized by steep slopes and sparsely vegetated rocky outcrops. They rely on keen eyesight and a supreme ability to reach high rocky perches quickly to escape predation.

During the winter, people in Owens Valley might see the sheep at lower elevations at the north end of the valley, near Bishop. The winter range of the Wheeler Ridge herd comes relatively close and the landscape allows the best chance for catching a glimpse of the remarkable animals.

The recovery program appears on track to meet its goals for downlisting the species. Anticipation remains high for meeting the ultimate goal of delisting the species.

"They are using more habitats than we previously knew they were using," said Stephenson. "Some are living year-round in alpine conditions."

The information suggests estimates of population numbers prior to the decline was underestimated. Stephenson said, "I'd prefer to say thousands," of these animals may have inhabited the historic range of the eastern slopes of the Sierra Nevada.

OWENS PUPFISH

There are some people who believe the diminutive Owens pupfish *(Cyprinodon radiosus)* had been around for more than 3 million years before it went extinct less than a hundred years ago.

Fish specialist Steve Parmenter is a senior environmental scientist with CDFW's satellite office in Bishop. Many considered him an Owens pupfish expert and he agrees with the most recent estimate of evolutionary history, accepting the species' age and believing it began life in what is now the Owens River Valley.

The Owens pupfish was abundant throughout the Owens Valley until 1940, when the species was believed extinct.

Measuring less than 2½ inches in length—with an occasional large male a little longer—pupfish males turn a bright blue in color during spawning. The distinctive behavior of 'tail wagging' during courtship and contest resembles the action of a playful puppy—hence the name pupfish.

The Owens pupfish is one of the nine western pupfish clade (organisms that evolved from a common ancestor) that live separated from one another in isolated ponds within a huge area spanning much of the west and southwestern North American continent. Exactly how the pupfishes diversified is not clear.

According to the U.S. Geologic Survey, the Sierra Nevada and Owens Valley are in one of North America's youngest geologic regions that stretches across much of California, Oregon and Washington. Consequently the geologic connection between the ancient river basins of the western continent has been obscured by the passage of time and the birth of new mountain ranges.

Scientists have theorized that given their tendency to live in low-gradient, valley-floor habitat, pupfish migrated during periods of transient surface water connections. Eventually, when these water connections were either disrupted or dried up, populations of the ancestral fish were entirely separated from one another and evolved into the nine species still in existence today.

"They can truly be said to be as old as the hills," said Parmenter.

Over decades, people introduced non-native trout, largemouth bass and bullfrogs to the waters of Owens Valley. The reasons varied, but they were brought primarily for bait, sport fishing and mosquito control. Pupfish became an easy source of food

No more than 600 bighorn (rams living up to their name) are left in Glacier National Park.

biologists have studied them here since the 1920s. Nobody had ever reported sheep wintering on Mount Allen, a large buttress on the main valley's south side. Yet that's where collars tracked wintering bighorns. GPS points also debunked a long-held belief that bighorn on adjacent slopes constituted a single herd; instead, sheep stay in separate herds throughout the year. Keating laughs: more than eight decades of bighorn research in Many Glacier has been overturned by fist-size GPS units.

He and geneticist Gordon Luikart of the University of Montana are getting even more bighorn insights from DNA samples. For instance, a preliminary study suggests that two populations living only 25 miles apart—one in Many Glacier and the other in Two Medicine—have surprisingly different genes. The contrast is "approximately the difference you would observe between Asians and Europeans. So it's a very large difference for such a small distance." Keating says it's possible the herds haven't mingled much since the last ice age ended more than 10,000 years ago.

Such isolation might protect the animals. In the 1980s, an outbreak of pneumonia wiped out 65 percent of southern Alberta's bighorn sheep and infected Many Glacier's population. But the Two Medicine herd was spared.

SIX MONTHS AFTER I WATCHED Keating and his crew collar sheep, we met again below Rising Wolf Mountain on a gusty day in May. We hiked up the purple pasqueflower-lined trail, listening to beeping radio signals picked up by three telemetry antennas. "Glacier is one of the worst places for radio tracking," Keating said, turning in a slow circle with an antenna overhead. "The mountainous terrain ricochets signals off cliffs, sending a strong beep from both the collar's location and its opposite direction." Our primary goal was to find six collars, most of which had been programmed to fall off two days earlier.

Our other task was to collect feces from ewe 118, the one we had collared in the fall. Hormone levels in fecal samples, which Keating sends to the National Zoo for analysis, indicate whether a ewe is pregnant. By combining this information with field observations of birth rate and survival rate, Keating can predict the herd's population growth. Ewe 118 was browsing on a steep hillside amid 40 sheep still in their white winter coats. Schmitz and another researcher pursued her across snow, ridges and cliffs. We wouldn't see them again for eight hours.

The rest of us followed well-worn sheep paths uphill—scrambling over rocks, slipping on pebbly scree. We were in prime bighorn territory, and collar 568 lay in plain sight on the rocks. Another collar was buried beneath early winter snows. Keating donned crampons and grabbed an ice ax to ascend a small, steep couloir, and dug it out.

As we trekked out along the muddy trail, sun glinted off Rising Wolf's snow-packed gullies. After 11 hours of hiking in Glacier's moody weather, we'd collected one ewe's scat, counted 84 bighorns and found four of six collars. Keating's pack cradled thousands more bighorn location points full of surprises.

BECKY LOMAX *is the author of* Moon Handbooks: Glacier National Park *and was a hiking guide in the park for 10 years.*

For more images of bighorn sheep, visit Smithsonian.com/phenom

ROBERT MACKINLAY / PETER ARNOLD, INC. / ALAMY

Floating M

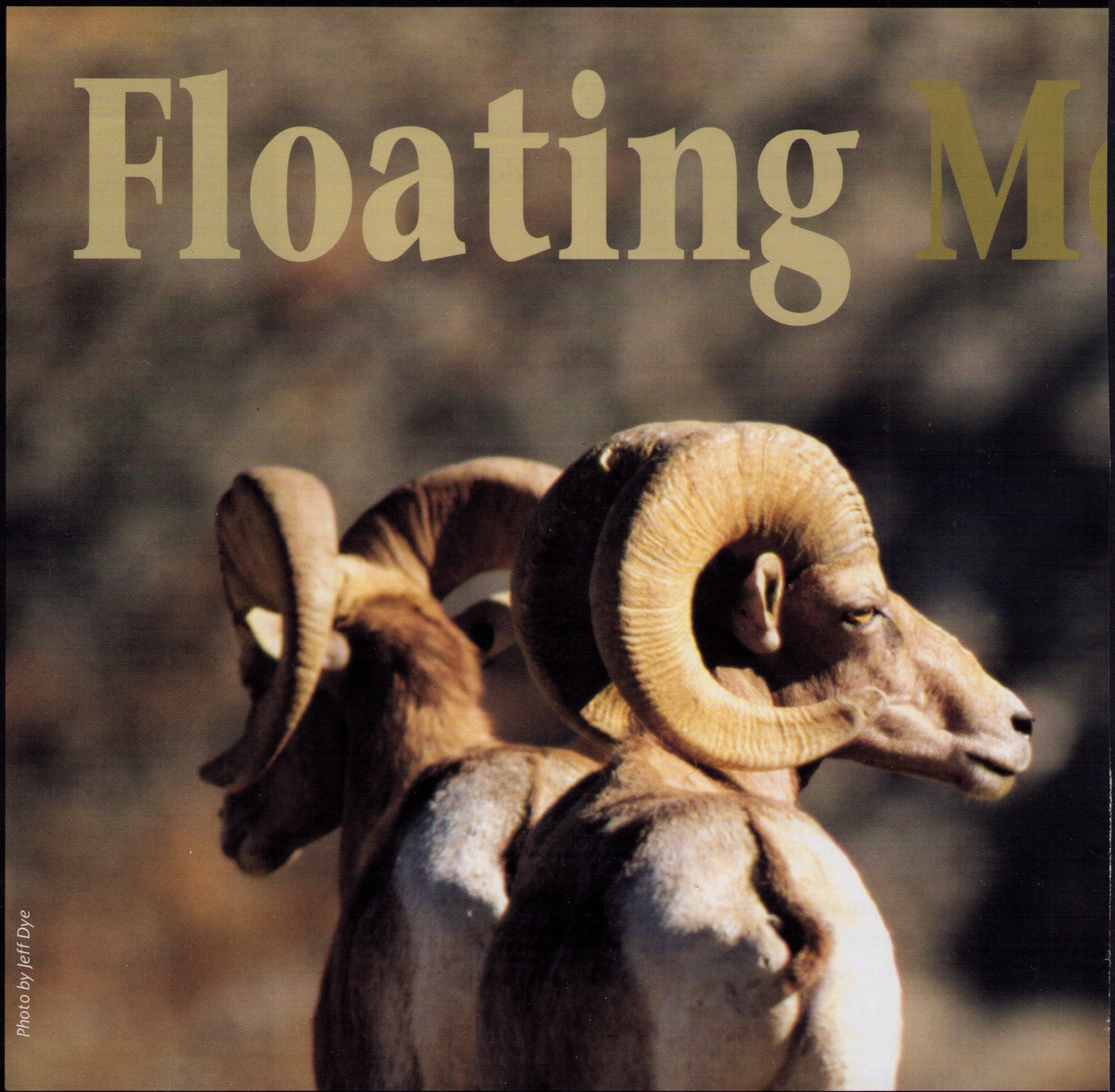


Photo by Jeff Dye

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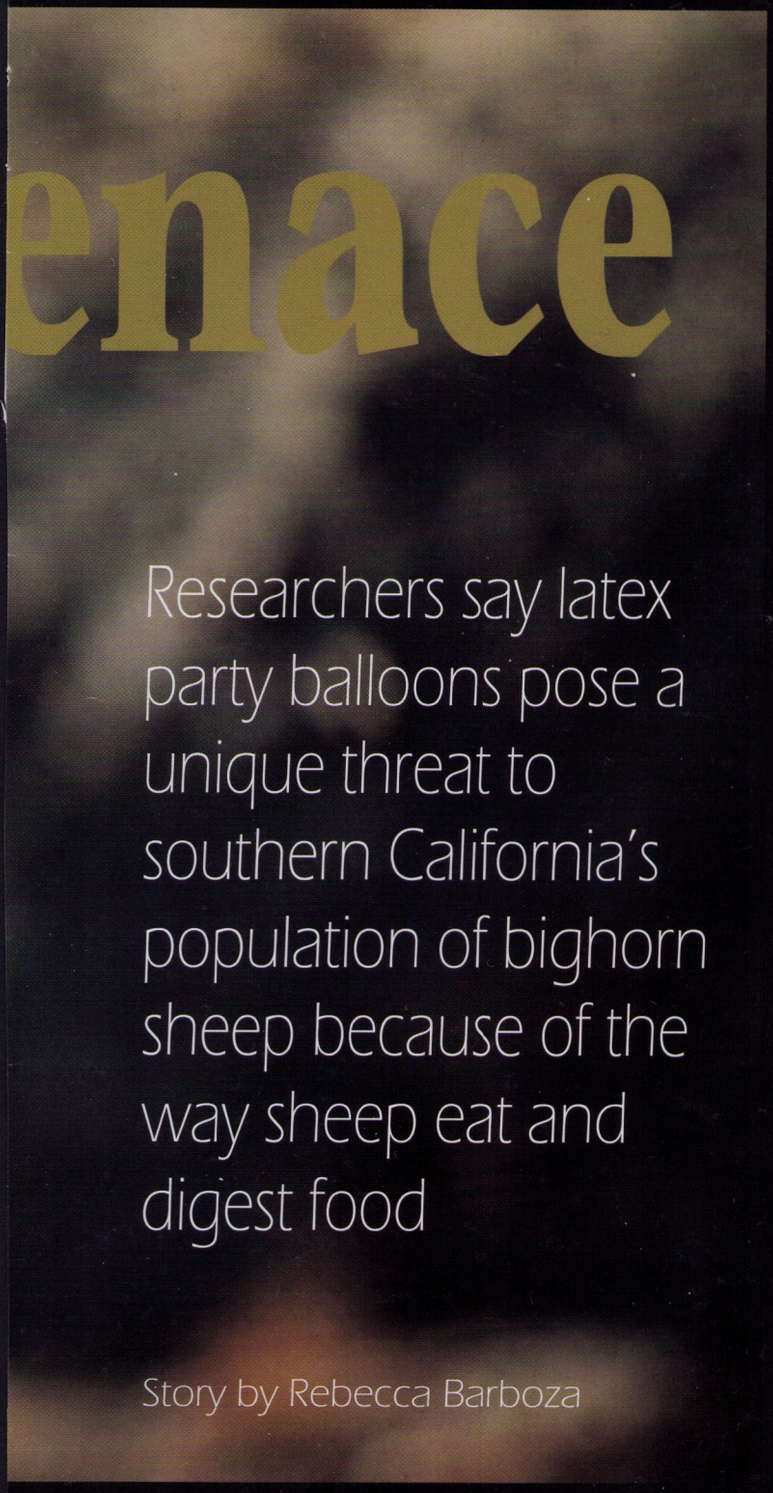


Researchers say latex party balloons pose a unique threat to southern California's population of bighorn sheep because of the way sheep eat and digest food

Story by Rebecca Barboza

A helium balloon wafting in the breeze across an endless sky hardly conveys a sense of peril. Yet these brightly colored spheres—frequent icon at parties, soirées and announcements—must eventually submit to the call of gravity and return to the environment where in southern California's high desert landscape they are creating a growing hazard for some of North America's rarest mammals.

For years, biologists have documented the negative impacts of latex balloons on marine wildlife. More recently, researchers have seen devastating evidence of what they can do to terrestrial wildlife as well. Of particular notice is how scientists are seeing more balloon debris in the rugged mountains of southern California. Specifically, they have found latex balloons near areas that support several populations of bighorn sheep.

Nelson bighorn sheep (*Ovis Canadensis nelsoni)* are designated as a fully protected species. The classification of fully protected was California's initial effort in the 1960s to identify and provide additional protection to wildlife that were rare or faced possible extinction. Throughout the 1990s some Nelson bighorn sheep populations were thought to be on the verge of collapse. Today, wildlife biologists believe they are recovering from years of poor habitat conditions and habitat loss, predation and human impacts.

In 2003, the Department of Fish and Game, along with the Angeles and San Bernardino national forests, began tracking local populations of bighorn sheep to better understand the animals long-term management needs. Researchers captured and marked sheep with radio collars to monitor their movements. When a marked animal dies, the collar emits a "mortality signal," which helps biologists locate the remains and determine the cause of death. During these routine mortality investigations, biologists regularly found remnants of latex balloons in the animals' stomachs.

"We have found everything from small latex fragments to entire balloon bouquets completely impacting the animals' digestive tracts," says Jeff Villepique, a DFG associate wildlife biologist. "If this were happening in just one location, we would probably consider it an anomaly. But our greatest concern is that this appears to be a ubiquitous occurrence in bighorn sheep populations that inhabit the urban-wild land interface of southern California and in the adjacent high deserts."

Photo courtesy of George Kerr, Society for the Conservation of Bighorn Sheep

While researchers have seen a growing number of mylar balloons—the shiny, less permeable metalized plastic films—in the same environment, only latex has proved a problem to sheep.

The extent of balloons littering the environment might surprise visitors to the wilderness, but not those who work there. And those who work in bighorn sheep habitat say they see it too often.

"I think it is fair to say that balloons are a common occurrence in the forest," says Kathie Meyer, a supervising biologist with the San Bernardino National Forest. "My staff regularly encounters and collects balloons, and when I worked for the National Park Service I dedicated an entire section of my office to all of the balloons that I personally collected."

Working with DFG's Inland Desert Region, Tim Glenner has flown as net gunner during dozens of helicopter surveys of bighorn sheep throughout the state. "During one three-day survey we counted 76 balloons in the San Gabriel Mountains," Glenner recalls. "I've had an aerial view of every bighorn sheep range in California and the balloon problem seems to be increasing in the southern mountain ranges."

The swell in latex balloons recovered from natural habitat crosses international borders. More than a year ago the British Broadcasting Corporation reported researchers there had marked a 260 percent increase in the number of balloons observed on Britain's beaches over the last 10 years. The newscast, referred to

DFG Photo by Rebecca Bartlow

Top photo: Balloons tangled in the wilderness, miles from where they were inadvertenly released, has become far too common a sight for DFG crews working wildlife programs. Above: Jeff Villepique, a DFG associate wildlife biologist removed enough balloons from one of the chambers of a bighorn's stomach to fill a plastic bag. Next page: An investigation of this deceased bighorn sheep showed the animal had swallowed plastic balloon strings while their other ends remained entangled in the sheep's mandible and teeth.

in the June 2008 issue of *Herp-Digest*, a scientific and conservation publication on reptiles and amphibians, stated nearly 60,000 balloons were identified during a two-day international survey.

> "During one three-day survey we counted 76 balloons in the San Gabriel Mountains. I've had an aerial view of every bighorn sheep range in California and the balloon problem seems to be increasing in the southern mountain ranges."
>
> Tim Glenner, DFG's Inland Desert Region

The impacts of latex balloons on wildlife—both terrestrial and aquatic—appear profound, but fortunately they are also preventable.

Researchers agree that ingested balloons and balloon fragments can potentially harm any species of wildlife. But bighorn sheep may be particularly at risk because of the way they eat and digest food. Bighorn sheep have the same digestive system as cows, goats, domestic sheep and other cud-chewing animals. They eat only plants, and have a specialized four-chambered stomach which extracts nutrients from indigestible plant materials. These animals do not chew food thoroughly as they graze. Instead, the un-chewed matter empties through the esophagus into the first stomach, called the rumen. Here, the plant matter softens and is kneaded into a mass and an initial process of fermentation by microorganisms begins. Larger food particles are later regurgitated back up through the esophagus into the mouth where it is re-chewed into smaller bits. This process continues as the food passes through the remaining stomach chambers. During this progression, microorganisms convert indigestible cellulose into nutrients that the animal can utilize for energy. Meanwhile a by-product of fermentation, methane gas, builds up inside the gut and is expelled as the animal belches.

"Foreign objects do not pass through the ruminant digestive system easily," says Dr. Ben Gonzales, an associate wildlife veterinarian with DFG's wildlife investigations laboratory. "Because of the complex process of regurgitation and re-swallowing, objects like latex balloons and their plastic strings can interfere with digestive processes and may create or contribute to numerous conditions that could ultimately result in death."

Balloons are not easy to swallow and animals can choke on the latex material. Unless the object is removed, suffocation and death can occur. In addition, the thin, rubbery material can block the esophagus, preventing the animal from expelling gasses. This can develop into ruminal tympany, a life-threatening condition

DFG Photo by Rebecca Barboza

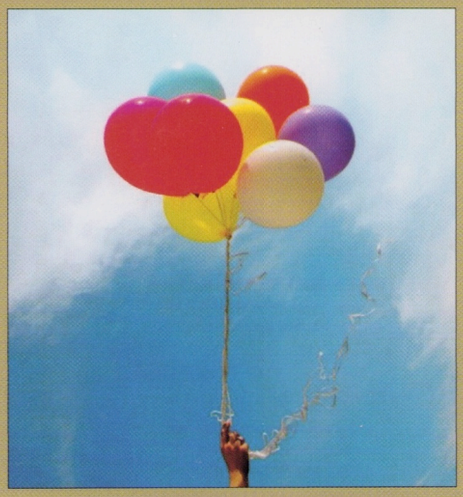
Floating Suggestions for Change

By Rebecca Barboza

State and federal wildlife agencies can maximize the bighorn sheep's existence by improving habitat and monitoring the population's health and movements, says Chanelle Davis, a DFG wildlife biologist, but the public holds the solution to the problem in their hands—literally. "We cannot solve the balloon problem without the public's help," she says.

Although balloons are a traditional way to celebrate, they can create a hazardous situation to our natural resources unless people utilize them in a responsible manner. Small efforts like proper balloon disposal make a huge difference when everyone participates. Everyone can enjoy balloons without risk to wildlife by following some simple suggestions:

- Consider filling balloons with air instead of helium to reduce the distance they travel.
- Do not release balloons outdoors.
- Attach weights to balloon strings or secure them tightly to solid objects.
- Use natural biodegradable, cotton string to tie balloons.
- Dispose of balloons after the celebration with a balloon-popping contest.
- Take the initiative and dispose of balloons that have been discarded in the environment.
- Some schools and businesses celebrate by displaying or releasing scores of balloons. Make an effort to discourage the practice and suggest alternative decorations.
- Share this information whenever possible.



The public can contribute to the success of a wildlife management program by encouraging change and educating others. The bighorn sheep is a symbol of the western wilderness and part of our natural heritage. Please join us in our mission to conserve California's wildlife for future generations. For additional information about bighorn sheep management programs in southern California, contact DFG's South Coast Region at (858) 467-4201, or the Inland Deserts Region at (909) 484-0167.

commonly referred to as "bloat." As the rumen fills with gas, the abdominal cavity becomes painfully distended and interferes with the animal's ability to breathe. If bloat is not treated immediately, the animal can die from asphyxiation. While remedies exist for closely attended domestic livestock, wildlife suffering bloat often endure a painful death.

Adding to the dilemma, helium balloons carry along an added menace. Researchers have found balloon strings through the length of bighorn sheep digestive tracts, from the esophagus to the intestines.

"Balloon strings can choke the animal and they can lacerate, perforate and strangulate the esophagus, intestines or other delicate membranes," Gonzales says.

"If a pet swallows a string, surgery is often required to remove these objects as well as sections of the damaged membranes," he adds. "Unfortunately, surgery is not an option for wild animals."

Gonzales points out that if an inflated balloon ruptures while being eaten by a bighorn sheep, balloon particles can be aspirated up the windpipe. Latex fragments can either block airflow, which leads to suffocation, or clog the system of increasingly smaller airspaces within the lungs, which leads to pneumonia.

"Clinical signs of aspiration pneumonia include fever, extreme discomfort, difficulty breathing and chronic cough," he says. "Death can also result from secondary infection. In addition, the loss of appetite, weakened condition and general malaise associated with this condition can make an individual more susceptible to attack by predators."

Wildlife biologists also worry over an accumulation of indigestible balloon parts, material that remains inside the animal and gives it a false sense that the stomach is full. If the animal constantly feels full, it won't eat sufficient amounts of food. Over time, it could starve itself.

Biologists want to understand the apparent draw of wildlife, especially bighorn sheep, to latex balloons. There's little information available to explain why these animals eat foreign objects like balloons in the first place or why they'll continue to chew the hard-to-swallow latex. Some anecdotal evidence suggests the animals intentionally target the bright-colored objects and not inadvertently swallow them while grazing.

"Domestic goats and certain big game animals like pronghorn have been known to approach red objects, but we don't yet know if it is out of curiosity or some other, more practical reason," says Villepique, the associate wildlife biologist.

An optimal balance between soil type, weather conditions and moisture promotes flower-production in plants, which can be an indicator of high-quality forage for wildlife.

"Bighorn sheep might be more likely to target brightly-colored objects because they mistake them as high-quality forage," Villepique says. "But, again, we have not yet determined this experimentally. This is just one of many possible hypotheses that might explain this behavior."

Rebecca Barboza is an Associate Wildlife Biologist with the California Department of Fish and Game, South Coast Region

CATCH & RELEASE

Surefooted, shy and scarce. These terms could apply to many of the animals that inhabit the rugged Eastern Sierra escarpment. But the application of the terms has a special meaning when you talk about the California bighorn sheep.

The sheep *(Ovas canadensis)* once roamed the 260 miles of the main crest in fairly high numbers, but when the white man (and his creatures) gradually invaded the landscape, the sheep virtually vanished, leaving only remnants of the once-healthy and thriving herds.

The bighorn's demise is an oft-repeated tale that can be told about many species that once inhabited the West. Virgin land is taken over by the ever-encroaching march of civilization. Animals are killed for food, fashion or sport. Domesticated livestock bring diseases that infect the native species, which have no immunity. The herds are killed systematically or they die off. The remainder recede farther into the wilderness, where survival becomes even more of a challenge.

The California bighorn sheep was a more or less common species in the Sierra before the white man arrived. But, by 1950, the population had dwindled to 390 sheep divided among five herds between Convict Creek, just south of Mammoth Lakes, and Mount Langley, near Mount Whitney. By 1970, the population was even thinner—around 230 sheep. Today, authorities estimate the entire population to be no more than 150.

Officials generally concur that the decline of the bighorn was caused initially by competition for forage, first with domesticated sheep, which were pastured in the high country, and later with cattle and sheep allowed to range in the bighorn's winter range along the base of the Eastern Sierra.

These same domestic sheep brought scabies disease, which was transmitted to the bighorn. Also, illegal hunting helped to slim the herds.

While many of these causes for the declines in numbers have been virtually eradicated, the population continues to decline. Reasons for this reversal in her numbers are not conclusive.

Some authorities believe that the increasing invasion of the high country by civilization is at fault, while others say that bighorns elsewhere have fared better in other parts of the country, even though human/bighorn contact was about the same.

Indeed, in a recent survey published by the Northern Wild Sheep and Goat Council, 30,700 of the Sierra bighorn's cousins, the Rocky Mountain bighorn sheep, were estimated to exist in the United States and Canada. In Wyoming alone, 6,300 of the Rocky Mountain sheep were tallied.

But, human contact with the Sierra bighorn cannot be totally discounted as a reason for its increasing scarcity. Visitors to the Inyo National Forest, where all of the sheep live, have increased tremendously over the years. The swarming populations of Los Angeles and San Diego, seeking recreation and relief from day-to-day urban stress, spill into the Eastern Sierra every summer to enjoy the beauty and solitude of the mountains. This increase in human contact with the high country has to play a role in the decline of the shy bighorn.

Most visitors to the Sierra, however, never see the creatures. As stated before, the animals are shy and wary of humans. Their deliberate caution and coloration make it virtually impossible to spot the animals even when one might be looking right at them.

The bighorn's hair and horns are a dun color, the same shade as the granite boulders and spires it inhabits. When grazing, it moves in a slow, methodical pattern, so as not to attract attention. When the animal is not grazing, it lies curled up and still among the rocks, becoming almost invisible.

Visitors to the Sierra in late autumn are more likely to *hear* the sheep than see them. In the fall, the bighorns begin to migrate down the eastern slope to their winter range. Here they feed on bitter brush, Mormon tea, wild buckwheats and other herbs and shrubs. Shortly after their arrival, the rams begin to fight for the small bands of ewes. The contests consist of head-butting, a battle which reportedly can be heard three quarters of a mile away.

The battles begin with kicking and quickly move into the head-butting contest. Two rams stand a few yards apart, rear up on their hind legs, then rush at each other head-first, horn to massive horn. The battle can continue for hours before one ram finally gives up. The victors are the only rams that mate that season. In this way, only the strongest rams contribute to the gene pool.

While the population of the bighorn in the Sierra continues to decline, efforts to save them are on the increase.

Noting the effect humans have on the creatures, officials have created a bighorn zoological area near Baxter Pass in the mountains above the Eastern Sierra community of Independence. The area is out of bounds for most people, unless they have a special permit. This area is the last stronghold of the species.

Also, officials are trying to re-establish the species in areas it once inhabited, but has since become extinct. One example is in Lee Vining Canyon, near the eastern entrance to Yosemite National Park.

Several years ago, officials decided to transplant several sheep from the Baxter Pass area to Lee Vining Canyon to re-establish the herd in Yosemite. The sheep were captured, fitted with radio collars and transported to the canyon. A severe winter and predation by mountain lions took a toll on the transplanted herd but did not totally decimate it. Then, in March 1988, another relocation took place.

Officials from the California Department of Fish and Game, the National Park Service, the Forest Service, the Bureau of Land Management and other agencies captured 11 of the elusive sheep and transported them again to Lee Vining Canyon to join the existing bighorns.

According to National Park Service biological technician Kathy Erwin, the recently transplanted sheep are doing quite well in their new surroundings.

"Out of the 11 sheep that were transplanted, four of the ewes had lambs in late May or early June of last year," Erwin said.

Erwin said that one ewe and one lamb were eaten by a mountain lion, but that is not uncommon.

"There are always lions in the canyon," she said. "They generally eat deer but the deer leave the canyon in the winter. It's a bonus [for the mountain lion] to have sheep there."

Erwin says the usually shy bighorns will let her get within 100 yards of them. Many times, she is able to observe them for hours. Also, the sheep come right down to the main road (State Highway 120) where they are attracted to a mineral lick exposed by the road cut. A sign warns motorists to exercise caution because of the possibility of an encounter with the sheep. So far, Erwin says, there has been no collision between motorists and the sheep.

One of the encouraging aspects of the attempts to reintroduce the herds to Yosemite and the surrounding area is the fact that several sheep from the originally transplanted herd have splintered off into other nearby canyons.

"There are four sheep in Bloody Canyon just to the south and two have moved toward Lundy Canyon to the north," Erwin said.

While the dispersal of the sheep could ultimately help the population, it could potentially have disastrous consequences because the bighorn's old nemesis, the domestic sheep, roams the other canyons.

"We've seen [domestic] sheep halfway up Mount Gibbs," Erwin said. At 12,700 feet, Mount Gibbs lies between the Lee Vining and Lundy canyons.

"If the bighorn have contact with the domestic sheep and then return to the main herd in Lee Vining Canyon, then we could be in trouble," she said. "We have to try to keep the domestic sheep at the lower elevations so they don't have contact with the bighorns." According to Erwin, there are no domestic sheep in Lee Vining Canyon.

Erwin said that a recapture of some of the original herd is planned soon. This recapture is being done so the radio collars fitted around the necks of the sheep can be replaced. Biologists use the radio signals to track the animals.

"The collars have a lifetime of about three years," she said.

Through the efforts of Erwin and others like her, the chances of survival for the California bighorn sheep are on the rise. The animal is still listed as "threatened" on the California endangered species list and its existence is tenuous at best. Perhaps through research and understanding of the bighorn and its habitat, "threatened" will not turn into "extinct."

Dear Annie: I need to

Several areas will be burned to help endangered species

3-17-2010

By Dave German and Tom Stephenson
Sierra Nevada Bighorn Sheep Recovery Program
California Department of Fish and Game

The eastern Sierra Nevada's hallmark wild mountaineers, Sierra Nevada bighorn sheep, were listed as a federally endangered species on Jan. 3, 2000.

This subspecies of bighorn sheep is unique to the Sierra Nevada, and has struggled to survive in a changing environment.

In an effort to help this species survive and thrive, the California Department of Fish and Game has promoted the use of tested methods – namely the "prescribed burn," or managed fire – as a viable wildlife management tool.

The prescribed burn that occurred in Shepard Creek on March 18 and 19 of this year was an important step on the road to restoring this endangered animal to its former abundance in the Sierra Nevada.

Bighorn sheep are commonly recognized by their horns, which continue to grow throughout their life (males have the larger curled horns while females have shorter, arching horns).

Typical bighorn live in the Sierra Nevada at elevations ranging from 6,000 feet during winter to 14,000 feet in the summer, but some bighorn live at elevations exceeding 11,000 feet year-round.

Though their diet varies throughout the year, bighorn need grasses, herbaceous plants, and shrubs to survive. They generally avoid heavily forested areas and dense vegetation in favor of the open terrain, where they can rely on their acute eyesight to detect predators from a distance and ensure adequate lead time to reach the safety of precipitous terrain.

Although bighorn once populated the Sierra Nevada in large numbers, the species has been in decline since the Gold Rush.

While a number of factors led to their decreased population, the effect of habitat change has been significant. Over the last 150 years, pinyon encroachment and fire suppression have collectively altered the low-elevation winter habitat by decreasing the foods they need to survive and increasing forest in formerly open habitats.

Historically, fire and thick brush have not been associated with optimal bighorn habitat. Their preference is for visually open, steep, and generally rocky slopes.

But fire can play an important role in creating and maintaining bighorn habitat. Scientific studies have identified two key benefits that fire can provide for bighorn: it ultimately leads to the growth of higher-quality nutritional forage, and it can clear away tall vegetation that impedes the bighorns' natural defense mechanisms against predators.

More than a decade ago, Diaz Creek and Lee Vining Canyon were successfully burned with positive effects for the two resident bighorn populations.

In 2000, a prescribed fire in Diaz Creek (Mt. Langley herd unit) created an opening in the pinyon forest that is now preferred by bighorn sheep and provides access to high quality forage on low elevation winter range (see Figure).

Prescribed burns haven't been used as a management tool in recent years, but DFG has collected substantial bighorn location data over the last decade, and the Department's Recovery Program has constructed habitat models to best predict where prescribed burns would be most effective.

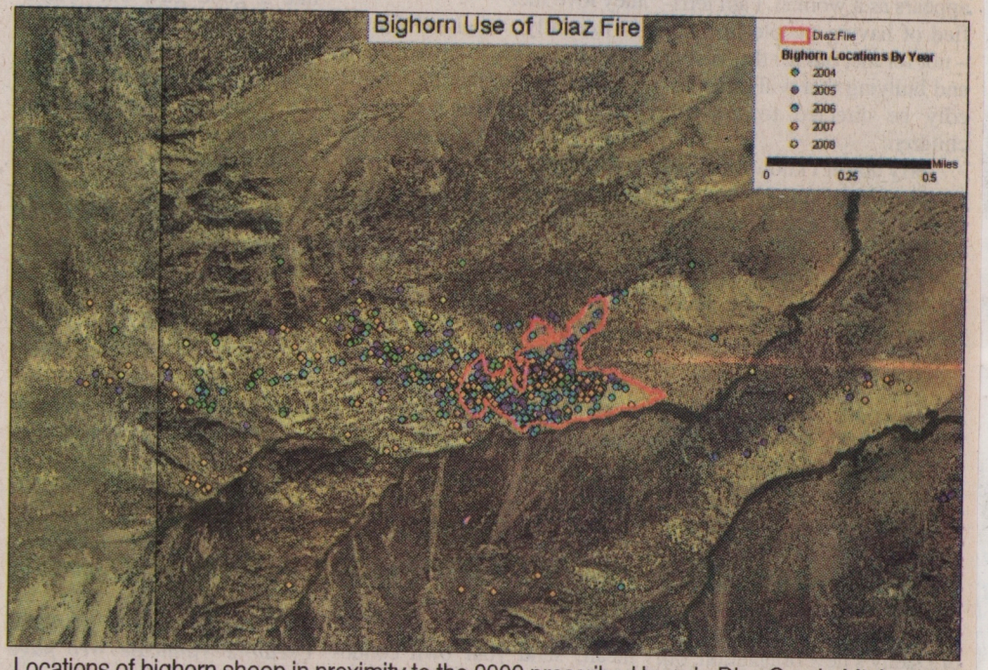
The models indicate that Shepard Creek and South Bairs Creek at the base of Mt. Williamson, as well as other canyons in the Mt. Langley and Mono Basin herds, will all benefit from prescribed burns conducted by the U.S. Forest Service (Inyo National Forest).

During the next several years, these key areas are scheduled to be burned as part of the recovery effort. All of these areas have experienced an increase in forest cover, are in steep terrain, and lie within the recovery area.

The burn areas are small, at about 200 acres, but this is about the same size as the previous beneficial burns. In conjunction with the burns, Recovery Program personnel will collect data to evaluate the effectiveness of habitat enhancement in promoting bighorn recovery.

Bighorn wearing GPS collars in the areas adjacent to burns will permit collection of location data that indicates the frequency of use of the burned areas. In addition, DFG will continue to collect data on population size, survival and reproduction that will enable us to examine differences in population growth before and after burning.

Fire spreading amongst pinyon trees and shrubs in Shepard Creek during recent prescribed burn. Photo courtesy California Department of Fish and game



.Locations of bighorn sheep in proximity to the 2000 prescribed burn in Diaz Creek, Mt. Langley herd unit. Photo courtesy California Department of Fish and Game

In the late 1990s, Sierra Bighorn numbered just over 100 animals across their range; today, they number almost 400 animals and are distributed throughout the Sierra Nevada from west of Lone Pine to almost Bridgeport. The improved habitat created using prescribed fire will likely increase the productivity of herds and improve the potential for reaching recovery goals.

WILDLIFE

4-21-2018

A FIELD TRIP TO SEE SIERRA NEVADA BIGHORN SHEEP

By Rea

There are only about 500 Sierra Nevada Bighorn Sheep in the wild, with a range from Olancha Peak to Yosemite National Park, and the Sierra Nevada Bighorn Sheep Foundation and the California Department of Fish and Wildlife provide the opportunity for the average Joe to view them in the Eastern Sierra.

"We don't find them just anywhere," says Dr. John Wehausen, who did his Ph.D. dissertation work on the SNBS in 1974 and has worked with the sheep ever since. "They need to be a dash from the rocks" in which they can be safe from predators.

The opportunities to view Bighorn Sheep from the Eastside in the late winter and early spring are unique, says Wehausen, because the sheep make a rare descent in elevation to graze on tender and nutritious plant shoots at the base of the mountains. As spring moves up in elevation, the sheep follow the melting snow and budding plants, a process that Wehausen calls "double dipping."

Wehausen calls them "drive up sheep" during this unique window.

After a brutal winter last year, in which the SNBS population declined by almost 100 members, the sheep that survived managed to put on enough weight to see a healthy population ready to lamb this season.

"The plants in the alpine environment are highly dependent on snowmelt," said Wehausen, "so there were patches of highly nutritious new growth" being uncovered until August and even September of 2017 (as those hiking in the High Sierra surely recall). "Those [sheep] that survived were in fat city!" said Wehausen. "In fact, our highest weights have been recorded following big winters."

At a field trip on February 2, participants saw three distinct groups of sheep in the Sawmill Canyon Area.

"Their eyesight is like a pair of binoculars," said Wehausen of the sheep. "If you see them, they've already busted you!"

However, during this period of feeding, Wehausen said, the sheep don't pay much heed to the humans gawking at them from below. "They know we're not a predator," says Wehausen. "It's very important [for the sheep] to be discerning about behavior," because running unnecessarily from a can expend valuable energy.

Folks come from all over to view the sheep during this time, says Ginnie Chadwick, volunteer extraordinaire and one of the most recognizable faces of the Sierra Nevada Bighorn Sheep Foundation.

Reverend Dale Matson of Fresno is "almost as nutty of a bighorn groupie" as Ginnie, she says. 'I don't want to call it a cult, please don't use that word, I'm a priest," says Matson, laughing. But he travels from Fresno to the Eastern Sierra as much as he can to see them.

"I think it's their rarity and their tenacity" that lends to their cachet," says Matson. "They're tough, but they're fragile at the same time."

Matson is an amateur photographer who has taken hundreds of photos of the rare sheep. "You become involved in their story…you're pulled into their life." Which is why people like Matson are so invested in their recovery—it's humans that put them in danger in the first place.

Wehausen has spent his life studying the genetic lineage of these sheep, which are distinct from the more common Desert Bighorn. For comparison: There are about 500 SNBS and about 5,000 Desert Bighorn Sheep from the Sierra Nevada to Mexico, says Danielle Glass, a scientific aide, who is one of a team of four—you heard that right—to study the more populous sheep species. The SNBS diverged about 300 thousand years ago, says Wehausen.

And human activity and development took a huge toll on the their population. "Freeways being built across the desert means very little gene flow [happens] across highways," said Wehausen. He also said that after the Los Angeles Aqueduct went in, many rams drowned trying to cross it in order to breed outside their natal groups.

This, coupled with massive die-offs as a result of pneumonia contracted from domestic sheep introduced into the Sierra in the 1800s (John Muir himself was a sheepherder), resulted in much of California and the entirety of Oregon and Washington losing their native populations.

Three populations—Mt. Williamson, Mt. Baxter and Sawmill Canyon—held the key to survival for the entire species. Thus, said Wehausen, SNBS have the lowest genetic diversity of any non-captive population of Bighorn Sheep.

"We owe [Wehausen] so much," says Matson, "because it was his discovery that the sheep were a distinct subspecies... Because of that, they were put on the endangered species list, so they got extra attention ..."

SNBS Fun Facts

Old timers

For a ram, 15 is a ripe old age, said Wehausen, but most are dead by 11-12, and many before that. "Females live a little more conservatively," said Wehausen—their life expectancy can be up to 20 years.

Horns like tree trunks

SNBS horns are actually made of a series of cones, one inside the other. The nutrients the animals ingest

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SNBS STATS

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determine the pace of ring growth, like the rings on a tree.

Sandpaper hooves

How do SNBS climb so well? Their hooves have two features. The first is an outer, tough hoof, which acts like a fingernail to protect the soft, convex inner hoof. Wehausen says it has the texture of sandpaper, which conforms to the micro topography of the rocks in which they live.

A dangerous childhood

Dale Matson told The Sheet that Bishop's Steve Yeager has seen SNBS lambs die after falling from cliffs while playing with their siblings. One badly-timed bump from a brother, and a deathly fall could result, said Matson.

What eats the sheep?

Their natural predators are mountain lions in the Sierra, but mountain sheep in other environments are also targeted by grizzly bears, wolves and even eagles, said Wehausen.

Lamb life

SNBS don't interbreed with Desert Bighorn, said Wehausen, because of several factors: There's a natural selection against hybrids because of a lack of ecological exchangeability—meaning that the life cycles of SNBS and Desert Bighorn are incompatible because of their breeding seasons. Desert Bighorns usually give birth in January. The SNBS' lifestyle is dependent on snow cycles, so they tend to begin lambing from April-June.

Females gestate for 176 days (very specific!), says Wehausen, and lambs nurse for about 22 weeks.

Not big drinkers

Interestingly, SNBS get almost all of their water from the plants they eat. "In 44 years, I can count on one hand the amount of times I've seen one drink water," said Wehausen. They do eat snow, he said, but a combination of lush feed and cool temperatures reduces their need for H20.

COUNTING SHEEP

By Bodine

As part of the White Mountain Research Center Spring Lecture Series, Dr. John Wehausen, Ph.D., discussed how he and his fellow scientists count the elusive Sierra Nevada Bighorn Sheep by recognizing their distinct markings.

His talk, "Up close and personal: Using pictures from automated cameras at desert water sources to recognize individual bighorn sheep and estimate population sizes" was not his first lecture at the Center. Wehausen gave the inaugural lecture at the center and has given more than he can remember.

Counting individual sheep is a daunting task, he explained. He used his work on Isla El Carmen in the Sea of Cortez as an example of trial and error techniques. He started counting sheep as he saw them without tagging or marking the animals, but it was not an effective way of getting an accurate number—there was no way to tell one sheep from another. Helicopters were deployed for aerial counts, but, Wehausen said, a more accurate count could be done on the ground.

That meant long hikes in extreme heat. Then he had his eureka moment. "Why not have the sheep come to us?" He began staging cameras at watering holes. "Let the camera do the work," he said. The cameras were first set at one frame a minute. Later, motion sensor cameras were employed.

As he began reviewing the images, he said he discovered he could recognize individual sheep by their natural markings; broken horns, or distinct patters on horns or fur.

This required he take many pictures to assure the accuracy of identification. He deployed what sports photographers call the "spray and pray" technique, where the camera takes multiple shots of a single scene.

He estimated he has looked at 8,000 photos, three times each. The duplication is needed for accuracy. He explained that he would see different things after each viewing.

A Sierra Nevada ram PHOTO: STEVE YEAGER

A MODERN DAY MUIR

By Gorman

John Muir hated domestic sheep. He called them walking locusts, said that "a sheep can hardly be called an animal; an entire flock is required to make one foolish individual." He spent weeks with a flock in the high Sierra and concluded that "sheep brain must surely be poor stuff."

And he was not commonly known for hating animals.

He once described a grasshopper approaching his camp as a "crisp, electric spark of joy enlivening the massy sublimity of the mountains like the laugh of a child." He wished goodnight to a bug in his ear, "restless, fussy fly with gauzy wings stirring the air around all the world." He described a bear that nearly mauled him as a "rugged boulder of energy in groves and gardens as fair as eden."

This man hated domestic sheep.

Was Muir wrong?

"He had no idea how bad they really were."

That's what Dr. John Wehausen, who spoke at the Mono Basin Scenic Area Visitor Center this Thursday, told me.

Dr. Wehausen gave a presentation entitled "Close Up with Sierra Bighorn," in which he discussed the center's exhibit on the species that he has spent four and a half decades studying. A species that just last year he watched, "die like flies," in the Mojave desert from exposure to a disease carried by domestic sheep.

"The greatest threat to Bighorn sheep today in the Sierra is contact with domestic sheep," said Dr. Wehausen. "If there is contact, we could have a complete pneumonia epizootic that will take out a whole population."

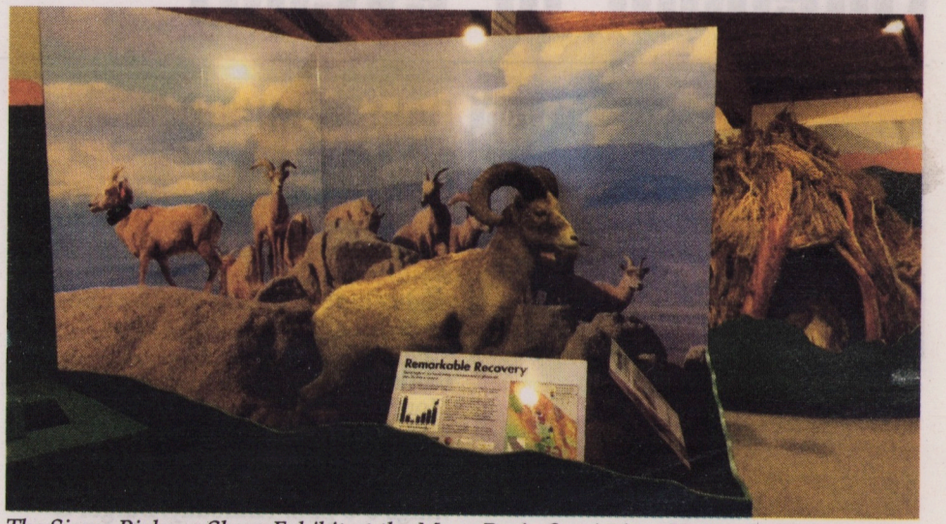
Dr. Wehausen hates domestic sheep. Little surprise that the Oakland Museum called him The Modern Muir, but the similarities run deeper than a disdain for domestic sheep.

"Muir was an inspiration to me as a naturalist, as a scientist, as a conservationist, and as someone who went into the wilderness alone." When Wehausen was an undergraduate at Berkeley he slept in the Sierra for two weeks without a sleeping bag, "just to see what it was to live that way, and to see what Muir did."

Dr. Wehausen began as a botanist, like Muir. In 1974, one of his professors introduced him to the plight of the Sierra Bighorn.

In 1999, when their numbers dropped below 100 animals, Dr. Wehausen wrote the petition that got the Sierra Bighorn on the endangered species list. Around the same time he became a molecular geneticist. A breakthrough allowed scientists to perform DNA research using animal droppings, and Dr. Wehausen saw an opportunity.

"I thought that was cool because that allows us to answer questions that we never could before." This is because scientists had to catch an animal in order to extract DNA from it, which is hard when the population is limited. Extracting DNA from droppings allows scientists to study a much larger population.



The Sierra Bighorn Sheep Exhibit at the Mono Basin Scenic Area Visitor Center.

Dr. Wehausen has thousands of DNA samples from these animals, so many that he has opened his own genetics lab in Bishop.

DNA study of the Bighorn is important because its greatest weakness is a lack of genetic diversity. That's what makes them susceptible to disease from domestic sheep.

Dr. Wehausen's efforts have been to increase the genetic diversity of the Bighorn in order to increase its disease resistance.

"They are at the low end of genetic diversity," said Dr. Wehausen. "We select animals with high heterozygosity [high genetic diversity] and move them into populations where they are needed."

This is a long term process, but Dr. Wehausen's efforts have yielded results. Since getting the Sierra Bighorn on the endangered species list, 14 different populations have emerged in the Sierra. The number of sheep is now up to around 650, and it would be higher if not for the harsh winter of 2016-2017.

VIGILANTE GENETIC BIOLOGIST

Dr. John Wehausen runs a genetics laboratory out of a cabin in Bishop to save the Sierra Bighorn

By Gorman

In a cabin on the outskirts of Bishop behind a pile of horse manure, Dr. John Wehausen has created a genetics laboratory dedicated to saving the Sierra Bighorn Sheep.

The Sheet wrote about Dr. Wehausen in its September 22 issue.

Wehausen has been working to save the Sierra Bighorn since 1974. In 1999, when their population dipped below 100 animals, he petitioned to get them on the endangered species list. Wehausen's efforts and his makeshift genetics laboratory have helped increase the Sierra Bighorn population to more than 600 in the wild today.

However, his funding stream from the state of California ran dry six years ago, when Wehausen was 63.

"I was forced to retire," he said, but there was still work to be done.

Instead of calling it a career, Wehausen decided to continue his work pro-bono, as a sort of vigilante genetic biologist.

In his ramshackle laboratory, he conducts experiments rarely seen outside of a research university, often on donated equipment or through processes he invented.

In fact, Wehausen takes pride in his out-of-date equipment - it's like a badge of honor. He built his own Class 100 clean hood, a piece that might cost thousands of dollars to purchase, out of a vacuum cleaner and some plexi-glass.

His ingenuity has allowed him to perform high level experiments with much lower costs.

Wehausen is tall and slight, with wire rim glasses and gray hair. He speaks quickly. He bandies terms like heterozygosity and promatograms, coming off as a mad scientist.

One aim of his research is genetic rescue, defined as, "biasing their [the sheeps'] genetic diversity up a little."

This is accomplished by locating rams with high heterozygosity and bringing them into populations where they are needed, or, better yet, creating new populations.

Dr. Wehausen in front of his genetics lab.

Dr. Wehausen must take roughly four steps in order to reengineer a population: animal capture, testing, relocation, and data measurement.

First, Wehausen needs to single out an animal in order to understand whether it is a potential candidate for aiding the genetic rescue of another population. Capturing a sheep involves first flying a plane over the area where a target population roams in order to identify its location. Once the plane has spotted the target, a helicopter is dispatched to the herd, and an animal is singled out. The animal is netted from the helicopter, and a researcher, often Wehausen, takes a blood sample from it, attaches a GPS collar that will allow him to track the animal, and puts specific colored tags on the sheep's ears for easier identification later.

Second, Wehausen takes the blood sample back to his lab in order to genotype the DNA of the now marked animal. The blood is put through a polymerase chain reaction (PCR) machine that copies the DNA so that Wehausen can study it. With about 2^40th copies of the DNA, Wehausen can genotype the cells using one of the three DNA sequencers he has. The sequencers were built in 1995, and the first was donated to Wehausen in 2001 from a lab when the machine was 6 years old.

"I'm probably the only person in the world who still uses this type of machine," Wehausen told me. The data that the sequencer spits out is then transferred to a Dell desktop that is more than a decade old. On the Dell, Wehausen "scores" the genes to see how heterozygous the subject animal is.

The greatest threats to Sierra Bighorn are domestic sheep and mountain lions. Domestic sheep are a threat because they carry diseases to which the Bighorn have no natural immunity. Epidemics can sweep through populations and wipe out dozens of sheep at a time.

see WEHAUSEN, page 9

WEHAUSEN

continued from page 8

Mountain lions are a threat because they have pointy teeth.

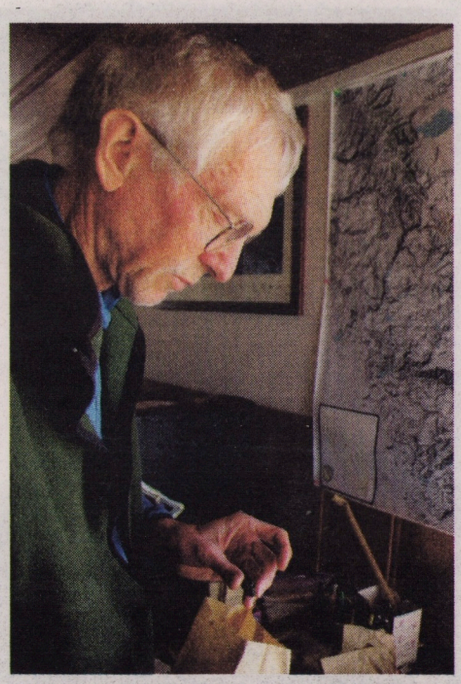
Wehausen concentrates his efforts on disease prevention more so than teeth prevention.

Sheep, like humans, are diploids; they receive a complete set of chromosomes from each of their parents. This means that they have two alleles (versions) of each gene. Those alleles can be different, which is known as heterozygous, or they can be the same, homozygous.

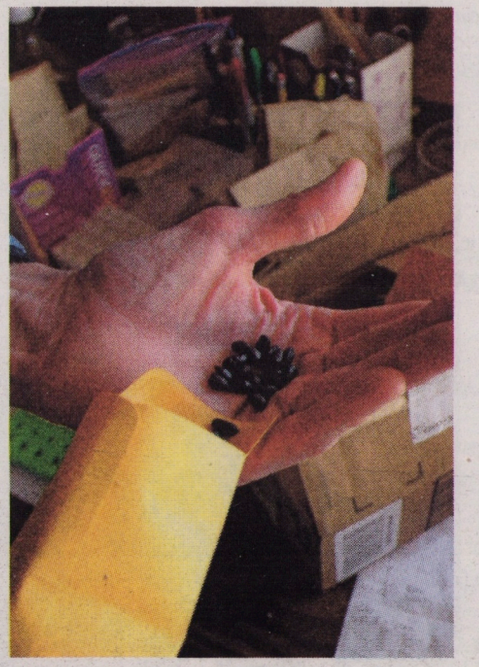
Wehausen looks for rams with a certain heterozygosity, and along with randomly chosen females, he moves the animals into a new geographic location to create a new population. New populations then increase their genetic diversity with each cohort of lambs, which will in turn create new, more diverse generations.

High heterozygosity not only benefits an animal's immunity, Wehausen has found that genetically diverse individuals are generally more fit. A more heterozygous female is more likely to have a lamb in the summer than a homozygous female.

If, after the genotyping is performed, the animal has the right types of alleles then the third step is recapturing it. This involves another plane and helicopter with a net gun. With the target animals captured Wehausen can either transfer them to an existing population or create an entirely new population. The latter is favored because smaller populations give researchers a better opportunity at promoting genetic diversity, since the researcher knows with more certainty which rams and ewes will end up mating.



Wehausen with a ram turd from the west-side meadow of Mt. Lewis



Wehausen with lamb pellets from August 2016 at Mt. Lewis

The relocation is often done toward the end of the ewe's gestation period, in March, because the sheep are more likely to stay in their new location if they are caring for newborn lambs.

The fourth and final step involves tracking the genetic diversity of the newly created populations through the droppings of the lambs.

Throughout the cabin/laboratory lie multiple piles of small manila packets, each indicating the date and location harvested in pen on its label, each containing the blood or poop of some far-off sheep. There's ram poop in the freezer. There's lamb poop on his desk. Three-year-old, neglected blood and poop sits beside the 2001 Dell that Wehausen uses to sequence genes. The pile of horse poop out front is used for fertilizing his apple trees. The doctor shovels poop all day for no pay, alone, and he prefers it that way.

DNA can be difficult to extract from the waste of herbivores, because the waste usually contains undigested plants which can contaminate a sample. Dr. Wehausen collects droppings in the field from each new cohort of lambs, and in his lab he performs a process that he invented whereby he scrapes the outsides of the pellets with a straight razor in order to extract only the animal DNA. Scraping the outside works because, "the mucilaginous coating on the outside of the pellets is the last to have come in contact with the gut, and contains the most animal bacteria," Wehausen said.

The Sierra Bighorn would likely would no longer be around had it not been for the efforts of John Wehausen, a man who scoffed at the system and, like Ol' Blue Eyes, has chosen to do it his way.

As long as there are John Wehausen's out there balking at the established order, taking matters into their own hands, doing the damn thing, there might still be hope for the great republic.

Recovery Actions

Translocations

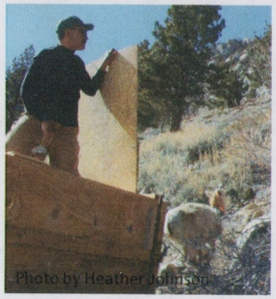


Photo by Heather Johnson

Translocation is essential to expand the geographic range or augment small populations to reach recovery goals. Translocations in the 1980s were used to expand the distribution of bighorn in the Sierra Nevada and are again being used today to augment local populations.

Disease

Contact between domestic and bighorn sheep frequently leads to outbreaks of fatal pneumonia in bighorn that may result in local population extinctions. Biologists have placed GPS collars on rams to better understand the potential for bighorn exposure to domestic sheep. State and Federal agencies are currently working to improve buffers surrounding bighorn sheep populations to reduce the risk of contact with domestic sheep.

Habitat enhancement

Prescribed fire can restore the open habitat that is preferred by bighorn. Open habitat has declined due to encroachment of pinyon forest. Inyo National Forest has engaged in such management for bighorn sheep in the Sierra Nevada beginning in 1990, and a number of future projects are planned.

Photo by Lacey Greene

Predation

Because these bighorn populations are small and increase only gradually, mountain lion predation has the potential to contribute to sheep population declines. Such predation problems can usually be attributed to one or a small number of lions that have switched their preference from deer to bighorn. Mountain lion management under this program attempts to identify and remove only lions that are killing bighorn sheep.

Recovery Goal

Downlisting and Delisting goals in the Recovery Plan require 305 ewes distributed in specified proportions among four recovery units that include 12 herd units. Currently, 7 of those herd units have bighorn sheep.

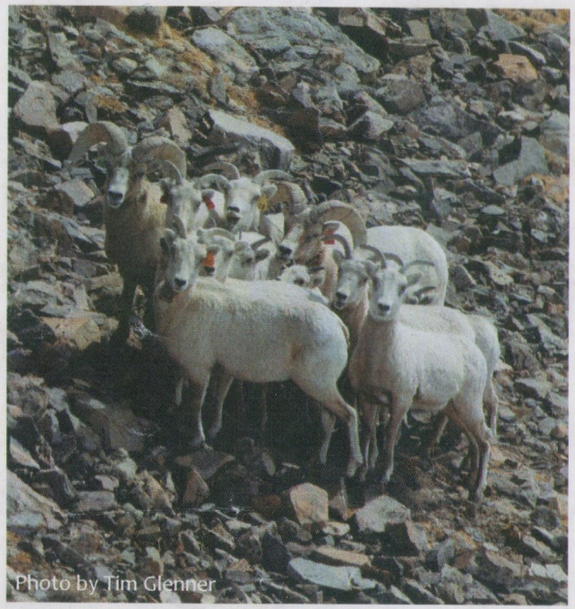


Photo by Tim Glenner

Viewing Sierra Nevada Bighorn: Pine Creek

Climbing activity in Pine Creek has recently increased. This is important winter and lambing habitat for one of our largest herds. We hope users in this area will have the opportunity to view bighorn and also the respect to help protect them by giving them space and keeping pets under control. Next climbing trip, bring your binoculars and a leash.

The Sierra Nevada Bighorn Sheep Recovery Program
California Department of Fish and Game
Bishop Office
407 West Line Street #1
Bishop, California 93514
Phone: 760-872-1171
Website: www.dfg.ca.gov

The Sierra Nevada Bighorn Sheep Recovery Program

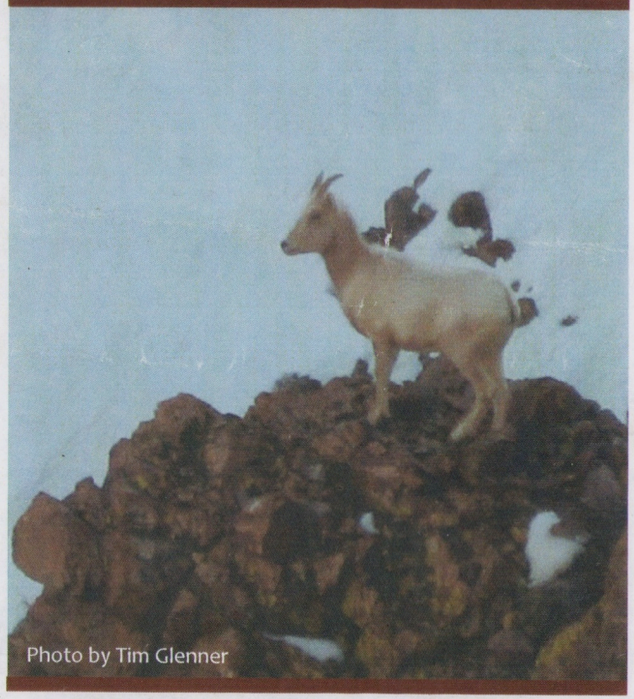


Photo by Tim Glenner

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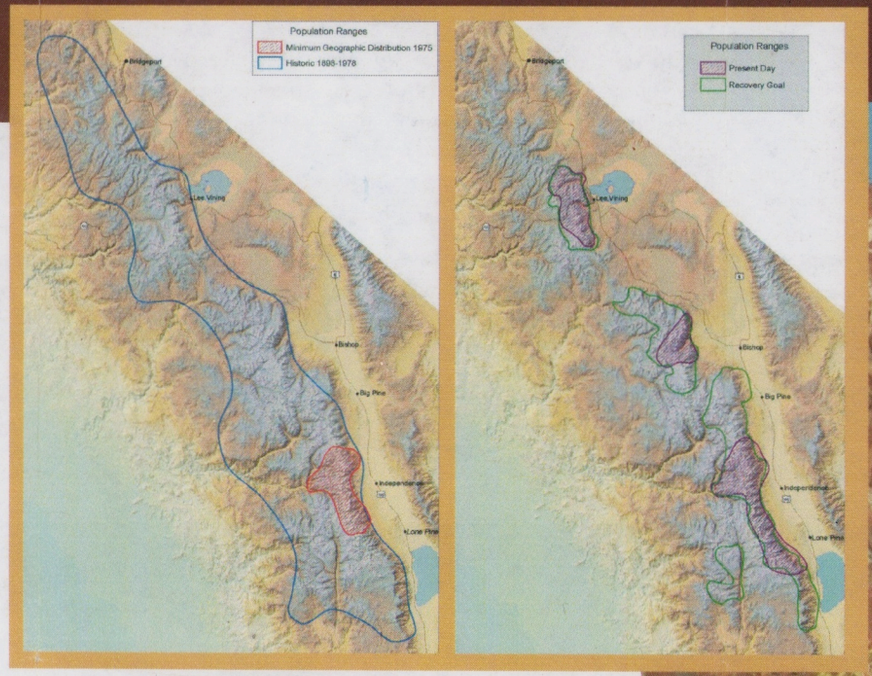
"The bravest of all the Sierra mountaineers"

The Sierra Nevada bighorn sheep (*Ovis canadensis sierrae*) is native only to the central and southern Sierra Nevada and is one of three subspecies of bighorn sheep. They diverged from neighboring desert bighorn about 400,000 years ago. Their populations began experiencing die-offs beginning in the 1870s coinciding with the beginning of domestic sheep grazing in the Sierra Nevada. Population losses continued into the second half of the twentieth century and left bighorn sheep surviving in only two areas east of Independence by the 1970s, totaling 250 sheep near the end of that decade. The Mount Baxter herd proved to be large and increasing and was used during 1979-88 to re-establish three herds in vacant historic habitat (Wheeler Ridge, Mt. Langley, and Mt. Warren). During the 1980s, bighorn in the Sierra Nevada dropped significanly. Populations declined to just over 100 total bighorn by 1995 from about 300 in the mid 1980s, and from in excess of 1,000 in 1850.

Sierra Nevada bighorn were listed as "rare", then "threatened", under the California Endangered Species Act beginning in 1972 and were upgraded to "endangered" in 1999 in response to a petition by the Sierra Nevada Bighorn Sheep Foundation. That same year these sheep were granted emergency "endangered" status followed by full endangered status by the U.S. Fish and Wildlife Service under the Federal Endangered Species Act as a result of a petition by the Sierra Nevada Bighorn Sheep Foundation and four other environmental groups. This action led to the creation of a major recovery program within the California Department of Fish and Game by the California Legislature. Such legislative action was unprecedented.



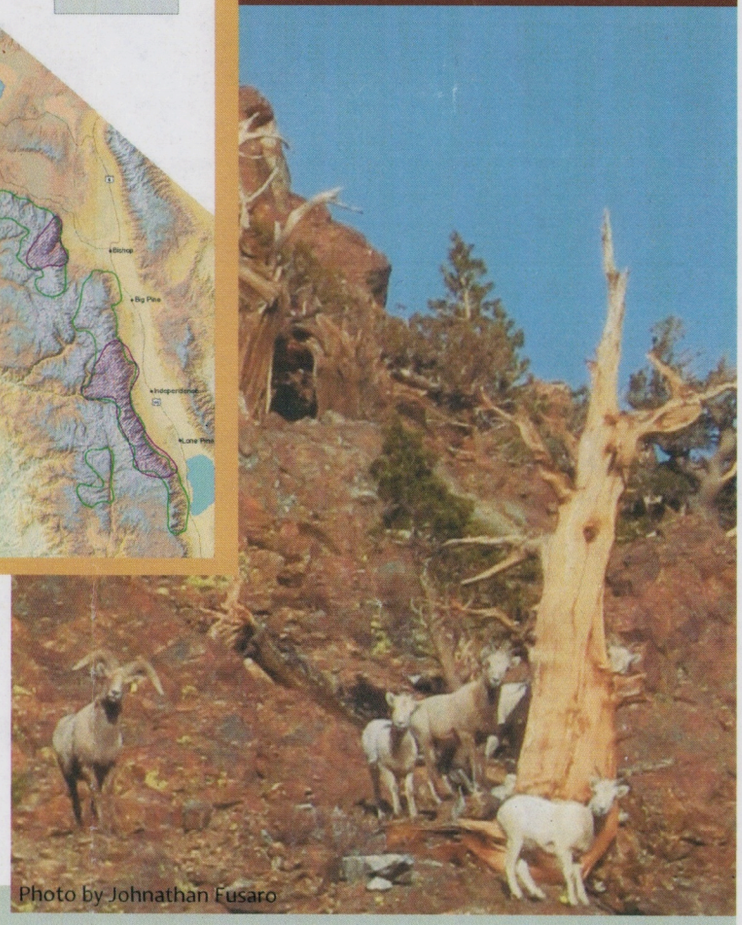


Photo by Johnathan Fusaro

Photo by Tim Glenner

Sierra Nevada Bighorn Sheep Recovery Program

The ultimate goal of the recovery effort is to enhance growth and increase the geographic distribution of bighorn in the Sierra Nevada to assure the population's long-term viability. The California Department of Fish and Game, in cooperation with other state and federal agencies, leads this recovery effort by implementing a recovery plan (http://ecos.fws.gov/docs/recovery_plan/080213_1.pdf) that was prepared by a recovery team that included a diversity of stakeholders. Since this recovery program began, the total number of bighorn has increased from 100 to 400.

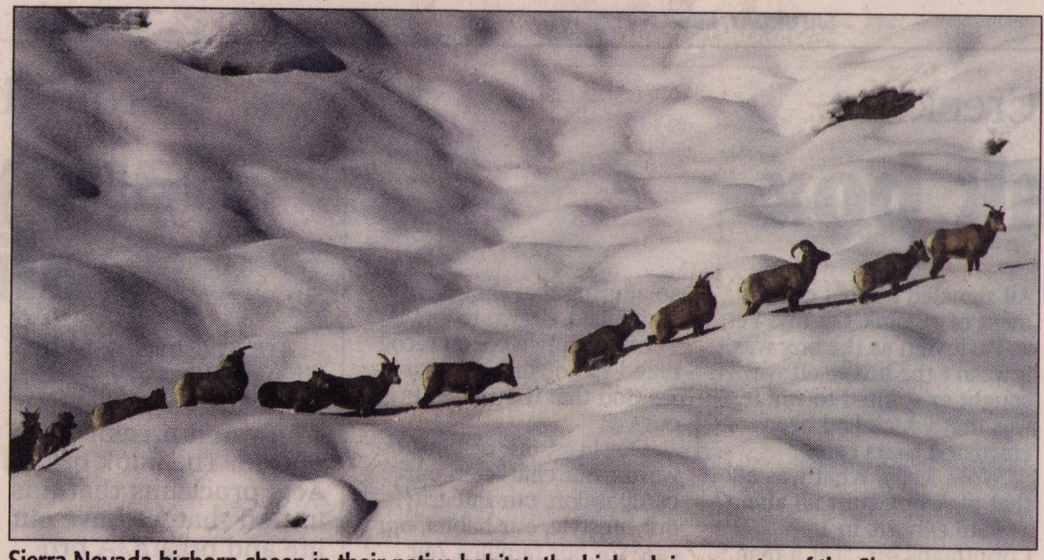
California Department of Fish and Game's Recovery Program implements an adaptive conservation approach that relies on scientific data collection to assess population viability and extinction risk. Key monitoring variables include:

• Population Size and Trend • Reproduction and Survival •
• Habitat Use and Movements • Nutritional Status • Disease Risk •

Mono County votes to end sheep grazing on Conway

Threat to endangered bighorn sheep overtakes pro-grazing advocates

By Wendilyn Grasseschi
Mammoth Times Reporter



Sierra Nevada bighorn sheep in their native habitat; the high, alpine country of the Sierra range.

Photo by Steve Yeager

Despite the pleas and passion of some of Mono County's traditional sheep and cattle grazers, the Mono county board of supervisors voted 3-1 Tuesday to end sheep and cattle grazing on the Conway Ranch property after November.

Although there were many reasons for the final vote, the primary issue for most of the 50 or so people in the packed supervisors' chambers in Bridgeport to support the vote was a fear that domestic sheep could transfer diseases to the Sierra Nevada Bighorn sheep, an animal listed on the federal Endangered Species list under the Endangered Species Act.

The decision, made with Supervisor Bob Gardner abstaining due to a possible conflict of interest issue and with Supervisor John Peters the "nay" vote, came only after hours of passionate and powerful testimony.

"We think that the value of this space, this county that we call 'Wild by Nature' as a wildlife habitat, as open space, is so much more valuable than its value as a place to graze domestic sheep," said one woman in the audience.

Many others in the audience agreed and voiced similar views, giving the supervisors a show of force against allowing sheep grazing to continue on the ranch.

The U.S. Fish and Wildlife Service also was present and after a long presentation about the state of the bighorn sheep recovery effort that has been underway in the Sierra for about two decades, biologist Dr. Tom Stephenson summarized the issue bluntly.

"We have tried everything to find a way to mitigate away the disease threat issue," he said. "The only thing that works fully is no contact between the domestic sheep and the bighorn."

He noted that once diseases enter a bighorn sheep population, it can take years and even decades for the herd to recover. Sometimes, he said, the entire herd needs to be killed and a new population re-introduced.

That's a problem for many reasons, he said, with one of the main ones being the stock, or genetic pool, of available animals already is so low.

Ranchers and pro-domestic sheep grazing advocates, some of whom have grazed the Conway for decades under a lease, were outnumbered, but they were passionate and powerful in their arguments,

"I want to say that no bighorn sheep has been hurt (by our grazing sheep)," said Marianne Lemassar. She said it was her understanding that predators were the main threat to the bighorn, not domestic sheep. "We have also grazed there for years, with no sighting of the bighorn sheep."

She noted sheepherding dogs, including "bossy border collies," and the big white Pyrennes breed used as guard dogs, had and would continue to, keep any bighorn sheep that might stumble onto the ranch away, thereby minimizing the possibility of contact between the domestic sheep and the bighorn.

Other pro-grazing audience members challenged the Department of Fish and Wildlife's report on the issue; everything from the accuracy of the maps, the models used to place the relocated sheep, and more.

"This reintroduction program in the northern areas has failed because it is not suitable for bighorn to thrive, not because of domestic sheep grazing," said one audience member.

Others argued that the science that indicated such an option was not clear or conclusive, the board noted that the issue had come up in court in previous cases and the courts had sided with researchers supporting the disease transmission possibility.

However, as the day wore on, it was clear that the tide of time and change was not in the ranchers' favor.

"The courts have already decided in favor of the disease transmission idea," said Supervisor Fred Stump, noting if the board allowed grazing on the Conway Ranch, it would open the county to a serious threat of litigation that he did not believe it could win.

He noted he, himself, would have been open to cattle grazing on the land since cattle do not present the same degree of danger in terms of disease transmission but his idea did not gain traction with the rest of the board or the audience.

In addition, the board voted to move to emphasize prioritizing moving much of the Conway Ranch parcel, now owned by the county, out of county ownership and/or management, due to the cost of maintaining the 1,000-acre-plus parcel

The board noted the county had made sure the property will be preserved as open space into perpetuity under a "conservation easement" agreement.

"Our main mission when we bought the property decades ago, to protect the property from development, has been met," said Stump. "Now, we are finding the cost of maintaining the property to be prohibitive."

He noted a lawsuit against the county that was settled last year regarding a previous aquaculture business leasee on the ranch cost the county $800,000. Added to that, he said, the new insurance rates due to increased liability after the settlement are about $70,000 a year. Along with other expenses, the ranch is becoming too expensive for the county to keep, he said, noting the money saved could take care of community centers needing work, help fix a paramedic availability problem and more.

"This was a very difficult decision," he said, words echoed by all of the other supervisors. "I admire and respect the ranchers. They are good and honest and hard-working people. But given everything we know about this issue now, I truly believe we had no where else to go."

A ROUGH WINTER FOR BIGHORN SHEEP

Local backcountry skier stumbles upon "graveyard" from avalanche

By Rea

Josh Mann, a Mammoth resident and avid backcountry skier, was ski touring in Esha Canyon on June 14 when, his legs burning from a long descent, he coasted to a stop and saw the skeleton of an endangered Sierra Nevada Bighorn Sheep.

"I wasn't looking at it, or going towards it, I just stopped and I was like, 'What is this?'"

Mann snapped a photo of the Bighorn's skull, fully intact, with a radio collar still attached to its neck. Once he got home, he called the U.S. Forest Service and the California Department of Fish and Wildlife (CDFW) to let them know what he had found. He said he found a second carcass that was "ripped to shreds," and that officials who later called him to thank him for reporting his find said they found three more carcasses in the canyon.

Tom Stephenson, Recovery Program Leader for the Sierra Nevada Bighorn Sheep with CDFW, told The Sheet on Thursday that the sheep found by Mann had most likely been killed in an avalanche.

Efforts to reintroduce the Sierra Nevada Bighorn Sheep, whose population was nearly wiped out due to diseases introduced from domestic sheep, have ramped up in recent years, with a herd being reintroduced into the Cathedral Range in Yosemite in 2015. The subspecies of Bighorn Sheep was listed under the Federal Endangered Species Act in 1999, but recovery efforts began as early as 1979, said Stephenson.

Stephenson said that, prior to this winter, there were about 600 sheep in the the native and currently occupied range, which spans from Olancha Peak in the south to Dunderberg Peak in the north and as far west as the Great Western Divide. Now the estimate is about 500 due to high mortality, though CDFW's summer surveys have not yet been conducted.

Mann said it was a rare find, and that he pinpointed the area on Google Earth for the USFS. He also said it got a little spooky once he found the first carcass.

"As we were skiing back down the canyon I was a little more aware. It was like skiing through a graveyard. At the bottom of the canyon was all the avalanche debris, and you'd be skiing down there's a broken tree and a rib. Then you'd ski further and there's some more broken trees and a hoof."

PHOTO:JOSH MANN

A Sierra Nevada Bighorn Sheep carcass as found by Mammoth Lakes resident Josh Mann.

When asked if he was at all tempted to have a Bighorn Sheep skull on his wall, Mann said he knew the right thing to do was to call the proper authorities. "I want to see a Bighorn Sheep in the flesh. Maybe get a picture of one and have that kind of a memory, I don't need one hanging on my wall."

Endangered Sierra Nevada Bighorn Sheep Restored to Yosemite and Sequoia National Parks

Recently Completed Cooperative Effort Included California Department of Fish and Wildlife, National Park Service, U.S. Forest Service, and U.S. Fish and Wildlife Service

A multiagency operation was recently concluded that returned two herds of endangered bighorn sheep to locations in Yosemite and Sequoia National Parks. The California Department of Fish and Wildlife (CDFW), Yosemite, Sequoia, and Kings Canyon National Parks, Inyo National Forest, and the U.S. Fish and Wildlife Service, worked together on the complex operation in the Sierra Nevada.

Between March 26 and March 29, 2015, nine ewes (females) and three rams (males) were moved from the Inyo National Forest and Sequoia National Park to the Cathedral Range in Yosemite National Park. In addition, seven ewes were moved to the Laurel Creek area of Sequoia National Park; the CDFW will attempt to move an additional 3 rams to that area on March 30.

The Sierra Nevada bighorn sheep is the only federally endangered mammal in Yosemite, Sequoia, and Kings Canyon. This animal was listed in 2000 after the population plunged to a low of about 100 individuals. The population has since increased to over 600, which marks an important milestone towards their recovery. Prior to the arrival of western settlers, which brought unregulated hunting and diseases in their livestock, bighorn sheep populations likely numbered in the thousands.

This latest chapter in the multi-year recovery effort involved the capture of Sierra Nevada bighorn sheep in wilderness areas on these federally managed lands. CDFW staff and volunteers, as well as veterinarians, biologists, and staff from other agencies, assessed the health and safety of the animals throughout the entire process. Each animal was fitted with a radio collar and a Global Positioning System (GPS) collar in order to track its movements over the next several years.

The newly released bighorn sheep are expected to thrive in their new homes because both of these historically occupied areas have superb summer habitat with adequate forage, are close enough to other Sierra Nevada bighorn sheep to provide the potential for connectivity among herds, and are far enough from most domestic sheep grazing areas to provide a buffer from potential disease transmission.

"This is a legacy event for Yosemite National Park and the bighorn sheep," said Don Neubacher, Yosemite National Park Superintendent. "Additionally, this is one of the Signature Centennial projects for the National Park Service and we are ecstatic to see bighorn sheep in the Cathedral Range for the first time in more than 100 years." March 2015

"This project would not have been possible without the leadership of the California Department of Fish and Wildlife and strong interagency cooperation with the U.S. Forest Service, and the U.S. Fish and Wildlife Service," said Woody Smeck, Superintendent of Sequoia and Kings Canyon National Parks.

"With this week's reintroductions, we now have bighorn distributed throughout all geographic areas identified as critical habitat in the Recovery Plan," said Tom Stephenson, leader of the Recovery Program with CDFW.

Yosemite Conservancy funded equipment and experts to bring the new herd into Yosemite National Park, as well as the GPS collars to track the animals' movement and location. Over the past 20 years, Yosemite Conservancy has funded nearly $630,000 to help protect bighorn sheep by supporting research, translocation efforts, radio and GPS collars. The Sierra Nevada Bighorn Sheep Foundation and the Wild Sheep Foundation funded the translocation into Sequoia National Park.

"Bighorn sheep are a true symbol of wilderness and represent the need to protect wild lands," said Frank Dean, Yosemite Conservancy President. "With the reintroduction, visitors will experience a wilderness similar to that found in the days of John Muir, when large alpine wildlife was abundant."

Sierra Nevada bighorn sheep are well known for their large size, strength, and ability to negotiate precipitous terrain. Adult males, called rams, stand over three feet tall at the shoulder and weigh up to 220 pounds; females, called ewes, weigh up to 155 pounds. Both rams and ewes have permanent horns; rams' horns are massive and coiled, whereas ewes' horns are shorter with less curvature. Bighorn sheep display a range of body coloration, from dark brown to almost white, and have a large white rump patch and a short, dark tail. Rams live to be 10 to 12 years old, and ewes live to be 12 to 17 years old. During breeding season (rut), bighorn rams compete for their right to mate with ewes. Dominance behavior includes kicking, butting, neck wrestling, and dramatic horn clashes that sound like thunder. Breeding generally takes place in November. Starting at two years old, ewes give birth to one lamb between late April and mid-June. Mothers typically wean their lambs by five months of age. The lambs become independent of their mothers when they are about one year old.

Sept 10, 2016

Hidden among the granite peaks in Sierra Nevada Mountains is one of the region's most charismatic mega fauna, the Sierra Nevada bighorn sheep.

A thousand or more of these rock-climbing ungulates, living in numerous herds, roamed the Sierra Nevada for thousands of years surviving two major ice ages. But in the mid-1800s their numbers began to plummet. By the 1990s, only around one hundred were known to exist; bighorn were staring into the abyss of extinction.

Now in 2016, recovery efforts have helped the Sierra Nevada bighorn increase in numbers: waxing and waning around 600. But the bighorn are now at a crossroads; sheer numbers don't guarantee a viable, sustainable population; however, placing these herds back in historic locations could.

To find these critical locations, scientists relied on historic texts to reveal first-person accounts of bighorn sightings.

A promising source appeared to be one person's century old prose, lavishly written, describing bighorn sheep. But this high profile individual seemed to lack two important words, "I saw ... " The exception was one account.

The famed John Muir chronicled one definitive observation west of Mount Humphreys and Emerson west of Bishop.

In Muir's book "The Mountains of California" published in 1894, Muir penned, "I chanced to look across the fall, and there stood three sheep quietly observing me. Never did the sudden appearance of a mountain, or fall, or human friend more forcibly seize and rivet my attention. Anxiety to observe accurately held me perfectly still. Eagerly I marked the flowing undulations of their firm, braided muscles, their strong legs, ears, eyes, heads, their graceful rounded necks, the color of their hair and the bold, upsweeping curves of their noble horns."

There were many other worthy accounts by John Muir, including those for the Atlantic Monthly in the 1870s, that sounded like first-person observations. But strictly speaking there is no real evidence of that.

Regardless, the many accounts related by Muir were important and added to the body of knowledge of historic bighorn herds throughout the central and Sierra Nevada Mountains.

As for hard evidence, bighorn populations left little trace of their existence, making it very difficult for scientist to recreate a clear picture of the past. Bighorn skulls were about the only tangible evidence available, so scientists had to carefully sift through the anecdotal evidence.

Experts now believe herds of Sierra Nevada bighorn sheep populated 200 miles of the Sierra Nevada range from Sonora Pass to the southernmost tip of the range at Jawbone Canyon. Herds also were thought to exist as far north as the Truckee drainage east of Reno, Nev. These northern herds disappeared remarkably fast shortly after white settlers became aware of them.

Euro-American awareness of the Sierra Nevada bighorn goes back to the mid-1800s. But within a few decades, bighorn herds began quickly vanishing, which led to California legislators passing laws to protect them statewide. Most people were convinced they knew the reason for the decline, but they were wrong.

As gold beckoned miners to seek their fortunes in California in 1849, the ever increasing hordes of humanity needed to be fed. On the dinner menu was bighorn sheep, and mining camps, as well as diners as far east as Bodie, took advantage of this native cuisine.

The elusive bighorn were not easy to find, they spent most of their summers at high elevation. However, bighorn were found at lower elevations when they took advantage of winter feeding grounds where they could be easy targets for hunters. It appeared that hunters were to blame for the animals' decline.

In 1879, alarmed by the accelerating loss of bighorn sheep, the state of California passed legislation to provide seasonal protection from hunters. That was followed three years later by permanent year-round protection. With that the Sierra Nevada bighorn were expected to recolonize the Sierra and flourish once again. It didn't happen.

Adding to the challenge, the ban on hunting meant Sierra Nevada bighorn were no longer considered game-animals; and only game-animals were funded for management.

The 1852 Fish and Game Act, followed in 1909 by the Fish and Game Commission and then changed to the Department of Fish and Game in 1951, did not allow for study or management of the bighorn sheep; they were on their own.

For the next 100-years, efforts to study, understand and address the decline were limited. There was little understanding of bighorn habitat, physiology, predation and interaction with livestock grazing at high elevations. So studies of bighorn were left to mountaineers and those that were willing to penetrate the wildest most rugged portions of the Sierra Nevada, men like Norman Clyde.

Norman Clyde was commissioned by the California Academy of Sciences in 1935 to be a special observer of the mountain sheep. Some of his adventures were chronicled in the June 1937 Automobile Club of Southern California's publication "Touring Topics." Clyde wrote about his pursuit of Bighorn "in their rugged, and in some cases almost inaccessible haunts."

Clyde cautioned other mountaineers against being consumed with tracking the sheep because "on account of his attention being fixed on his quarry, he may suddenly find himself involved in a hazard which would probably have been avoided had his adventure been a purely mountaineering one." Clyde recalled "dancing on a mass of rocks giving way beneath me and going crashing down the mountainside."

Another important figure, fascinated by Sierra Nevada Bighorn, was as an employee of the Fish and Game Commission, Edward Ober.

In 1911, Ober was Owens Valley's first game warden stationed in Big Pine. In an unofficial capacity, Ober spent decades following the bighorn throughout the peaks of the Sierra Nevada, and his observations became instrumental in building the body of knowledge of bighorn. In 1914 his excursions took him to one of the most northern known herds, the bighorn on Mount Tom west of Bishop.

In Lone Pine, another game warden Vern Burandt, stationed there for 25 years, added to the understanding of bighorn. But this game warden was not just looking for bighorn; he was looking for Norman Clyde, who was known for allegedly breaking a few laws.

The cat-and-mouse pursuit went on for years, but in the end they shared a common passion: the bighorn. And in their later years they developed a mutual respect for each.

Further north in Mono County, Mono National Forest employees on their own joined the quest for knowledge by piecing together the history of bighorn herds in that area. The Mono National Forest was created in 1908 from parts of Inyo, Toiyabe, Stanislaus and Sierra national forests; then in 1945 it was dissolved and divided between Toiyabe and Inyo National Forests.

During this time a hint of official protection was being devised and written into a 1940 document proposing an area of protection on Mt Williamson, later to be known as the California Bighorn Zoological Area in the Southern Sierra. But it languished on a dusty shelf for decades. Meanwhile World War II broke out and everything halted. However, at war's end, one man picked up where everyone else had left off.

Fred Jones published his 1949 master's thesis on the Sierra Nevada bighorn sheep, which compiled past studies and observations. The history of Bighorn was finally being assembled and created a momentum that eventually led to official funding of studies.

In 1972, the California Bighorn Zoological Area on Mount Williamson became a reality, designed to protect one of the last known herds, the Mount Williamson/Baxter herd. In 1974, Dr. John Wehausen began his life-long work studying the Sierra bighorn, and contributed greatly to the knowledge of the biology and character of the bighorn. But it would take around 30 years before his and others' contributions would bear fruit.

By the mid-1990s bighorn numbers were down to around 100, representing a non-viable population on its way to extinction. But a remarkable turn-around was about to take place.

The passion and hard work of many people over many years, the efforts of Dr. Wehausen, Fish and Game employees, many others, resulted in the bighorn's extraordinary ascension to around 600 in 2015.

However, their placement back into historic herd locations remains a work in progress. Reaching a truly sustainable population, where human intervention is no longer necessary, remains a challenge.

The last few miles will be the steepest yet on a trail to sustainability.

John Muir considered the Sierra Nevada bighorn "the bravest of all Sierra mountaineers." Those mountaineering skills stand as an inspiration to those who must scramble up those last few cliffs to attain what seemed to be, at one point, a near impossibility: removing the Sierra Nevada bighorn sheep from the endangered species list.

by
Ted Williams

Frog designation to leap on economy

Federal classification could shut down popular rec areas

By Kristina Blüm
Register Staff 9-24-2016

The critical habitat designation for the Sierra Nevada yellow legged frog will go into affect Monday and county officials say the area could feel it economically.

While the United States Fish and Wildlife Service removed a few areas of concern from habitat designation that had concerned Inyo County, the vast majority of the map of habitat designation remained unchanged.

Some 1,812,164 acres are set to be designated as critical habitat, including some of Inyo County's most popular fishing holes, Inyo County Planning Director Joshua Hart said during a meeting of county supervisors Tuesday.

"This could have a big impact to the county," Hart said Friday. "I'm sure it was not on purpose but when we were looking at the maps, it's almost as if they designed it to have the biggest impact possible."

The USFWS has said that backcountry activities such as fish stocking, grazing, recreation, timber harvest and fuel reduction and dams and diverting waterways all have adverse impacts on the amphibians.

State Fish and Wildlife officials, for more than 15 years, have removed trout from several backcountry lakes above Independence, Big Pine and Bishop, in an effort to provide the frogs with suitable habitat, as trout prey on tadpoles.

During its meeting Tuesday, the Inyo County Board of Supervisors heard a report from county staff regarding the final rule of the designation. In it, South Lake, Rock Creek, Rock Creek Lake, Lamarck Lakes and Lamarck Creek were removed from the designation list. However, the upper part of Bishop Creek, Treasure Lake, Pine Creek, Robinson Lake, Independence Lake, Baker Creek, Coyote Flats, Mulkoy Meadows and Birch Creek remained in the designation even after Inyo County expressed concerns in several letters to the USFWS.

"We're disappointed that the USFWS didn't incorporate our comments and didn't

See FROGS ▶ Page 3

Proposed critical habitat designation for the yellow legged frog expected to have major economic impacts on Inyo County.

Photo courtesy U.S.

Continued from front page

take our concerns seriously, specifically dealing with areas within the critical habitat that are not frog habitat," Inyo County Second District Supervisor and Chairman Jeff Griffiths said Friday.

"The county has argued that fishing, recreation, livestock grazing and packing are not the primary threats to the species," according to county documents regarding the designation. "However, these continue to be listed as threats to be addressed."

"We are obviously very concerned because these are very important to our recreation-driven economy," Hart said. "They (USFWS officials) always say that it's not that big of an issue, but they've closed parts of the Pacific Crest Trail because of these habitats. We are not in agreement with them when they say that this is not an issue."

The area's economy could take a $17 million hit annually because of the designation, according to county documents.

"The USFWS dismissed these concerns and argues that the incremental approach it utilizes will result in minimal impacts," the documents state.

"They didn't do an economic analysis on the local economy and cumulative impact of multiple listings," Griffiths explained. "Their analysis only included impacts to federal agencies, not to the local economy. We provided them with an economic analysis by consultants that the county hired but they did not include that."

Hart said the county has advised the Forest Service to work with the California Department of Fish and Wildlife, which has a much more balanced approach.

"If the USFWS does that, it might be just fine," Hart said. "But if it is something more severe, such as closing trails, eliminating fish or forcing businesses to close, it will be a very different story."

Hart went on to say that the county has found evidence that cattle grazing, when properly managed, may actually have beneficial impacts on the frog.

The county has corresponded with the USFWS regarding the frog issue since 2013 when the USFWS first brought up the issue of a critical habitat designation for the Sierra Nevada yellow legged frog, mountain yellow-legged frog and Yosemite toad.

Josh Hart, Inyo County Planning Director

At a September 2013 joint meeting of the Inyo County Board of Supervisors with USFWS and California Department of Fish and Wildlife representatives, nearly 100 Inyo County residents voiced concerns that the proposed habitat designations would further limit access and recreational opportunities in the Sierra.

Much of the public comments collected during that meeting were concerns regarding businesses dependent upon tourism.

Supervisors advised county staff to compose a letter to the USFWS to, as Fifth District Supervisor Matt Kingsley said during Tuesday's meeting, "... call out exactly the lakes they didn't remove, thank them for the ones they did, and mention that we think there's still a problem with Coyote Flats."

"Our plan is to monitor it closely and decide what action to take if it does impact those important things to our culture and economy," Griffiths said.

Photo by Shutterstock

HELPING THE HERD

2011

The Eastern Sierra is home to a wide variety of animals, many of which you may see as you drive along Scenic 395, including tule elk, rattlesnakes, jackrabbits, coyotes, black bear, mule deer, Western gray squirrels and red-tail hawks. One of the more elusive animals, one you are unlikely to see even if you hike to remote areas, is the Sierra Nevada bighorn sheep, which lives exclusively in these mountains.

Authors and filmmakers have documented the tale of the Sierra Nevada bighorn sheep and their distinct subspecies based on recent genetic evidence. These bighorn sheep have the most restricted range and the fewest individuals of any bighorn subspecies. They are one of the rarest of large mammals in North America and are listed under the Endangered Species Act.

OVER

BISHOP

The bighorn sheep are about five feet in length. Both males and females have permanent horns. The horns of the males are much larger and more curved. The Sierra Nevada bighorns have more splayed horns with a less pronounced curl than the Desert bighorn rams,which have a tight, narrow curl. They exhibit a range of coats from a dark brown to almost white. Sierra bighorn rely on keen eyesight to detect predators and monitor their movement.

The sheep are built for covering short distances rapidly, over steep, rocky terrain, which is their means of escaping predators. Compared to other hoofed animals that flee across more level terrain, they have shorter, stockier legs with fore limbs that appear shorter than their hind limbs.

Historically, bighorn sheep were distributed along the crest of the Sierra Nevada from Sonora Pass in the north, to Olancha Peak in the south. Scientists estimate that there were more than 1,000 bighorn sheep in the Sierra Nevada range prior to European settlement. However, the Sierra bighorn population plummeted during the 19th and 20th centuries because of diseases from domestic sheep, forage competition with domestic livestock and market hunting. By the late 1970s, there were only two geographic areas where bighorn sheep were found (in the vicinity of Mt. Baxter, north of Independence, and Mt. Williamson, south of Independence), with a combined population of 250 animals.

Between 1979 and 1988, California Department of Fish and Game (DFG) relocated bighorn sheep from the Mt. Baxter area to Wheeler Crest, west of Bishop, to Mt. Langley up out of Lone Pine, and to the Mono Basin above Lee Vining, to re-establish herds in historic ranges. These recovery efforts were thwarted by another major die-off during the 1990s, attributed primarily to mountain lion predation and drought. By 1995 only about 100 bighorn sheep remained in the Sierra.

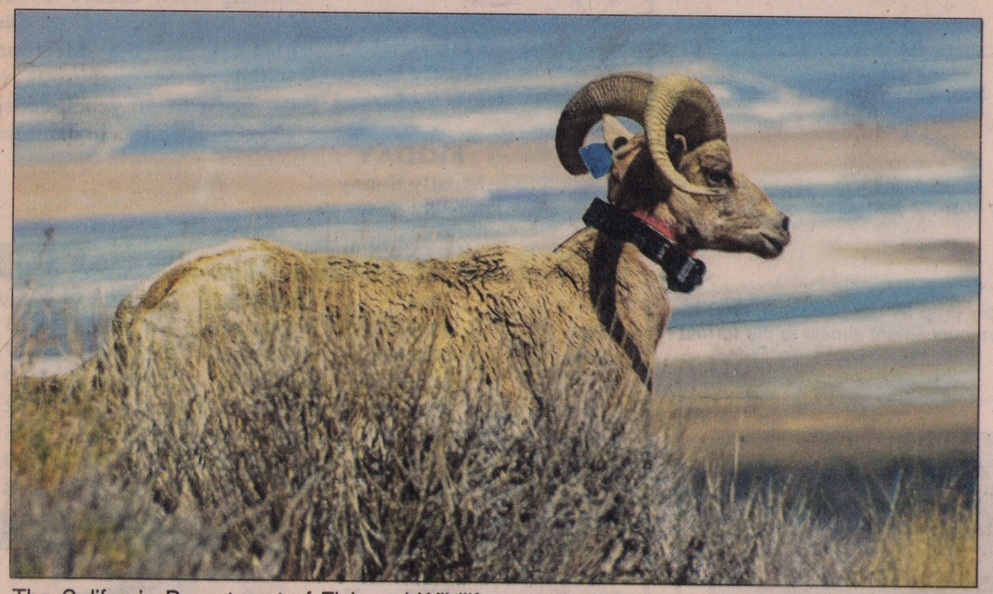
The Sierra Nevada bighorn sheep were on the verge of extinction. DFG wasn't about to let that happen. Their ongoing conservation efforts focuses on a recovery area that encompasses two national parks (Yosemite and Sequoia-Kings Canyon), four national forests (Inyo, Humboldt-Toiyabe, Sierra, and Sequoia), and lands managed by the federal Bureau of Land Management. The recovery area is almost entirely federal land and most of it is in federally designated wilderness areas (John Muir, Ansel Adams, Hoover, and Golden Trout).

Since their listing under the Endangered Species Act, the Sierra Nevada bighorn sheep population has grown from about 125 individuals in 1999 to about 400 in 2010. Of the 16 areas identified as suitable habitat, Sierra bighorn are currently occupying 10. The fate of the sheep appears to be improving.

Future goals for downlisting the sheep from endangered to threatened status require approximately 305 females distributed among four herds, occupancy of 12 of the areas, and successful prevention of contact between bighorn sheep and domestic sheep and goats. If those numbers hold for seven years without intervention, the bighorn could be delisted.

As the numbers increase, the Sierra Nevada bighorn sheep continue to stick to their rough, rocky and steep terrain. They can be found feeding on grasses and shrubs in alpine meadows, on summit plateaus, and in hanging meadows that are fed by springs within escape terrain. The bighorn sheep need all the help they can get and this topography affords them a small advantage in avoiding predation.

Viewing areas during winter include in and around the cliffs of Wheeler Crest from Pine Creek Road just west of Rovana. During the summer the Cottonwood Lakes Basin and Mount Langley area are good areas to look for bighorn. These animals are difficult to observe since they blend in with their surroundings, so do not be surprised if you have difficulty locating them. A good pair of binoculars or a spotting scope will help. For more information see the California Department of Fish and Game website **www.dfg.ca.gov/snbs** or email asksnbs@dfg.ca.gov



The California Department of Fish and Wildlife recently created a new herd of Sierra Nevada Bighorn Sheep near Olancha Peak in an effort to help the endangered native species re-establish itself in areas that have not seen a herd since the early 1900s. Photo by Andrew Hughan/courtesy CDFW

4-6-2013

Southern Sierra gets first new sheep herd in 100 years

Department of Fish and Wildlife relocates bighorns to Olancha Peak area to re-establish species there

By Mike Gervais
Register Staff

With the population of the endangered Sierra Nevada Bighorn Sheep at 500 and rising, the California Department of Fish and Wildlife is attempting to establish a new herd near Olancha Peak.

The DFW worked March 25-27 to relocate 14 bighorn sheep from healthy herds to the Olancha Peak area, which was home to a herd that died out in the early 1900s.

The creation of the Olancha Peak herd represents the first reintroduction of Sierra bighorn to historical habitat since 1986.

Historically, bighorn sheep were abundant throughout the Sierra Nevada; however, according to the DFW, by the 1970s, only two herds remained. "Disease spread by domestic sheep and unregulated commercial hunting are believed to have caused their demise," DFW Public Information Officer Andrew Hughan said via press release.

Last month, the DFW relocated 10 female and four male bighorn sheep from the Sawmill Canyon and Mt. Langley herds, two of the largest existing herds in the Sierra Nevada. Six additional females were moved to two small northern herds and Convict Creek and Mount Gibbs, for augmentation.

Dr. Tom Stephenson, program leader for DFW's recovery effort, said that no new herds were created from 1986 to the present, because there simply were not enough of the animals to support a new herd.

"To do a reintroduction, we need a healthy population in the existing herds and the population declined to about 100 animals in the 1990s," Stephenson said.

He said the new herd created in Lee Vining Canyon in 1986 almost immediately split into two herds, and both are thriving.

Stephenson explained that the DFW uses advanced scientific methods to relocate the sheep. From the beginning planning stages, DFW personnel begin monitoring the herds that will be used to create a new population, selecting for removal animals that are not related, are likely to reproduce and are free of disease.

Once the animals that were relocated were selected, the DFW used helicopters and net guns to capture, sedate and transport them to a processing center that was set up to evaluate each individual animal. The evaluation before re-release gives DFW biologists a look at the overall health of the herd the sheep are coming from, as well as an idea of the habitat the new herd will seek when re-released.

Stephenson said each bighorn was assessed and fitted with a radio collar and GPS collar that will allow biologists to track its movement and health before being set free in the Olancha Peak area.

"We will follow the GPS tracker daily for two years, and also do ground surveys to learn about the habitat they're using," Stephenson said.

Following the re-creation of the Olancha Peak herd, there are now 10 herds of Sierra bighorn between Owens Lake and Mono Lake.

Stephenson said three additional herds are needed to meet recovery goals, but planning for the creation of those herds won't begin until biologists are sure the newest herd is healthy and thriving.

"Many endangered species remain on the brink of extinction with poor prospects for recovery after they receive federal protection," Stephenson said. "Through our conservation efforts, we have a unique opportunity to reach recovery goals for an alpine specialist that is native only to California. We are really excited. It's neat to have the opportunity to start new herds again."

"The Bravest of All the Sierra Mountaineers"

That is how the great naturalist John Muir referred to the Sierra Nevada Bighorn Sheep. The bighorn is the very symbol of our High Sierra wilderness. These sheep live in some of the most remote and austere regions of the Sierra Nevada Mountains of California, and once ranged from Sonora Pass to Mineral King in Sequoia National Park. Their rugged character matches the steep rocky mountain wilderness they call home. Their short legs and stocky builds allow them to move with agility and grace on steep, rocky slopes of the Sierra.

Sighting of these majestic mountain sheep in their lofty home has awed and inspired many mountaineers since John Muir's time. Those who has been fortunate to catch a glimpse of them on Sierra peaks has come home enriched by their encounter with these rare mountain monarchs.

Recent genetic and cranial shape research has found these sheep to be a unique form of bighorn found only in the Sierra Nevada. Sierra Nevada bighorn are rarer than the Florida Panther, and even rarer than the California Condor. They are clearly one of the most endangered mammals of North America.

"The wild sheep ranks highest among the animal mountaineers...Their feeding grounds are among the most beautiful of the wild gardens, bright with daisies and gentians and mats of purple bryanthus... Here they feast all summer, the happy wanderers, perhaps relishing the beauty as well as the taste of the lovely flora on which they feed."

John Muir "The Wild Sheep" 1881

Sierra Nevada Bighorn Sheep are on the Verge of Extinction

Despite legislative protection since 1878, the Sierra Nevada bighorn sheep are in serious danger of extinction. Following the penetration of their mountain range last century by domestic sheep that transmitted diseases to bighorn sheep and gold miners who hunted them, populations began disappearing as early as the 1870's. A century later, only 250 sheep in two populations remained, on Mt. Williamson and in the Mt. Baxter area, west of the town of Independence in Owens Valley.

Between 1979 and 1988, three additional populations were established in bighorn's historical range in the Mt. Langley area south of Mt. Whitney, Wheeler Ridge west of Bishop, and the Lee Vining Canyon area east of Yosemite by capturing and moving sheep from the Mt. Baxter population. The initial success of this State and Federal interagency cooperative reintroduction effort increased the total population of Sierra Nevada bighorn by 25 percent. However, during the 1980's, dramatic increases in the mountain lion population that preyed on these bighorns reversed this trend.

By 1996, the total population of Sierra Nevada Bighorn Sheep numbered only 120 sheep. Two of the five populations in the Sierra are now teetering on the edge of extinction, and it is doubtful that Sierra Nevada Bighorn will survive without considerable outside help.

The Sierra Nevada Bighorn Sheep Foundation

The continued existence of Sierra Nevada bighorn sheep depends on a coordinated effort of research and conservation action. The Sierra Nevada Bighorn Sheep Foundation was formed in 1995 by concerned independent and government wildlife biologists and a private citizen to help coordinate the recovery effort for this unique denizen of these mountains. The foundation works closely with State and Federal resource agencies in developing sound conservation strategies and plans and carries out research essential to the recovery of these sheep.

The Sierra Nevada Bighorn Sheep Foundation is funded by donations from organizations and people who care about the survival of Sierra Nevada bighorn sheep and the overall unique ecosystem of which they are a part.

A rare Sierra Nevada mountain monarch

Big Horn Sheep
of Silver Canyon
Photo by
Ann Aylesworth

Desert Bighorn Ram
November 2018
Photo by
Dana Felthauser

Wildlife Interrupted

Scientists are documenting the profound impact of human-powered recreation on imperiled wildlife during the winter.

BY HILARY EISEN, *Policy Director at Winter Wildlands Alliance*

INTRODUCTION BY WENDY SCHNEIDER, *Executive Director, Friends of the Inyo:*

As a hiker, backcountry skier and rock climber, I have long believed that my recreational activities have little or no effect on wildlife. This belief has been based on the fact that these activities do not involve a motor or a machine, and my movement is relatively slow. In recent years, however, I have been made aware that the impact of my quiet recreational activities is much greater than I believed.

As humans seek to occupy and develop more and more land, including for recreational uses, Friends of the Inyo seeks to insure that, here in the Eastern Sierra, the needs of our wildlife are considered. Recreational tourism plays a critical role in our economy. Friends of the Inyo's engagement in management and planning for our Eastern Sierra public lands, (for example in the ongoing development of the management plan for the new Alabama Hills National Scenic Area, or the upcoming development of a winter recreation management plan on the Inyo National Forest) is always based on the best available science, and always seeks to find a balance between the desires of the recreation community and the needs of wildlife. As the following article demonstrates, finding that balance can be difficult.

The Teton Range in Wyoming is a special place for backcountry skiers. Its unmistakable skyline holds some of the best and most iconic skiing to be found in the world. The Tetons are also an important refuge for wildlife. Many species make their home in the Teton Range, including the threatened Teton bighorn sheep herd.

Historically, bighorn sheep were abundant and widespread in the Tetons. Biologists estimate more than a thousand bighorns once lived in the range, although it's impossible to say for sure. Every fall, they migrated out of the mountains to winter in warmer, drier low-elevation foothills. However, development and human impact have affected the bighorn's annual migration patterns.

Over the past several decades, bighorn sheep in the Tetons have stopped moving to lower elevations for winter in order to avoid humans. Now, they live year-round in the high reaches of the range. As a result, their population has dropped dramatically, to approximately 100 animals. Biologists fear this unique population may go extinct.

For a long time, we've understood that motorized recreation disturbs wintering wildlife, and land managers often close winter ranges to motor vehicles to protect vulnerable species. However, new research is showing that non-motorized recreation, like backcountry skiing, can disturb wintering wildlife, too.

To better understand why bighorns are struggling in the Tetons, researchers spent two years tracking sheep and people throughout the range. While many factors contribute to their decline, the impact of backcountry skiing is significant. Sheep are sensitive to human activity, especially when they are confined to tiny, windswept

PHOTOS: Josh Metten/Ecotour Adventures

alpine islands. When a skier comes into view, the sheep run, often through deep snow, sometimes for a long time, to find a new "island" with no sign of people. This skittishness consumes more energy than the sheep can afford. Combine this with the ever-present threat of avalanches, and many bighorns don't survive the winter.

As a conservation organization that speaks for the backcountry ski community, Winter Wildlands Alliance is uniquely positioned to advocate for winter wildlife conservation. We work with public land management policy experts who are well-versed in using policy tools to protect winter wildlife habitat from human impacts. We're passionate about skiing, but we recognize that people are mobile and have a range of options of where to ski. Wildlife don't have that same luxury. It's our responsibility to ensure recreation doesn't negatively impact wildlife.

Protecting winter wildlife habitat has long been a conservation priority on both public and private lands because it's critical to ensuring wildlife populations persist. A 2019 study in the northern Rockies found that both motorized and non-motorized winter recreation disturbs female wolverines, causing them to stop using areas within their home range where lots of recreation occurs. An animal's home range is defined as the region that encompasses all the resources an animal requires to survive and reproduce. Home ranges are never bigger than what an animal truly requires, so anything that causes an animal to lose or stop using part of its home range is cause for concern.

Winter is a tough season for almost every critter, and animals are sensitive to human activities whether we're on foot or astride a motor. Food is scarce. It takes a lot of energy to stay warm and move around. It's also when many females are pregnant, and late winter and early spring is when many species give birth. As conservation-minded skiers who value wildlife, we have a responsibility to work with land managers and biologists to ensure that our recreation isn't harming the wildlife we share the landscape with.

The answers are still being developed. Right now, we're working with land managers, other conservation groups, winter recreationists, and biologists to develop management recommendations that the Forest Service can use during winter travel planning to protect wolverines while continuing to provide winter recreation opportunities.

Likewise, this winter in the Tetons, we'll be working with skiers, biologists, land managers, and wildlife enthusiasts to find a way to protect the Teton bighorn sheep herd. If you would like to get involved or learn more, attend one of the collaborative meetings and help us figure out the best course forward for the sheep and skiers of the Teton range.

For more information, contact Hilary Eisen at Winter Wildlands Alliance or the Teton Bighorn Sheep Working Group at TetonSheep.org.

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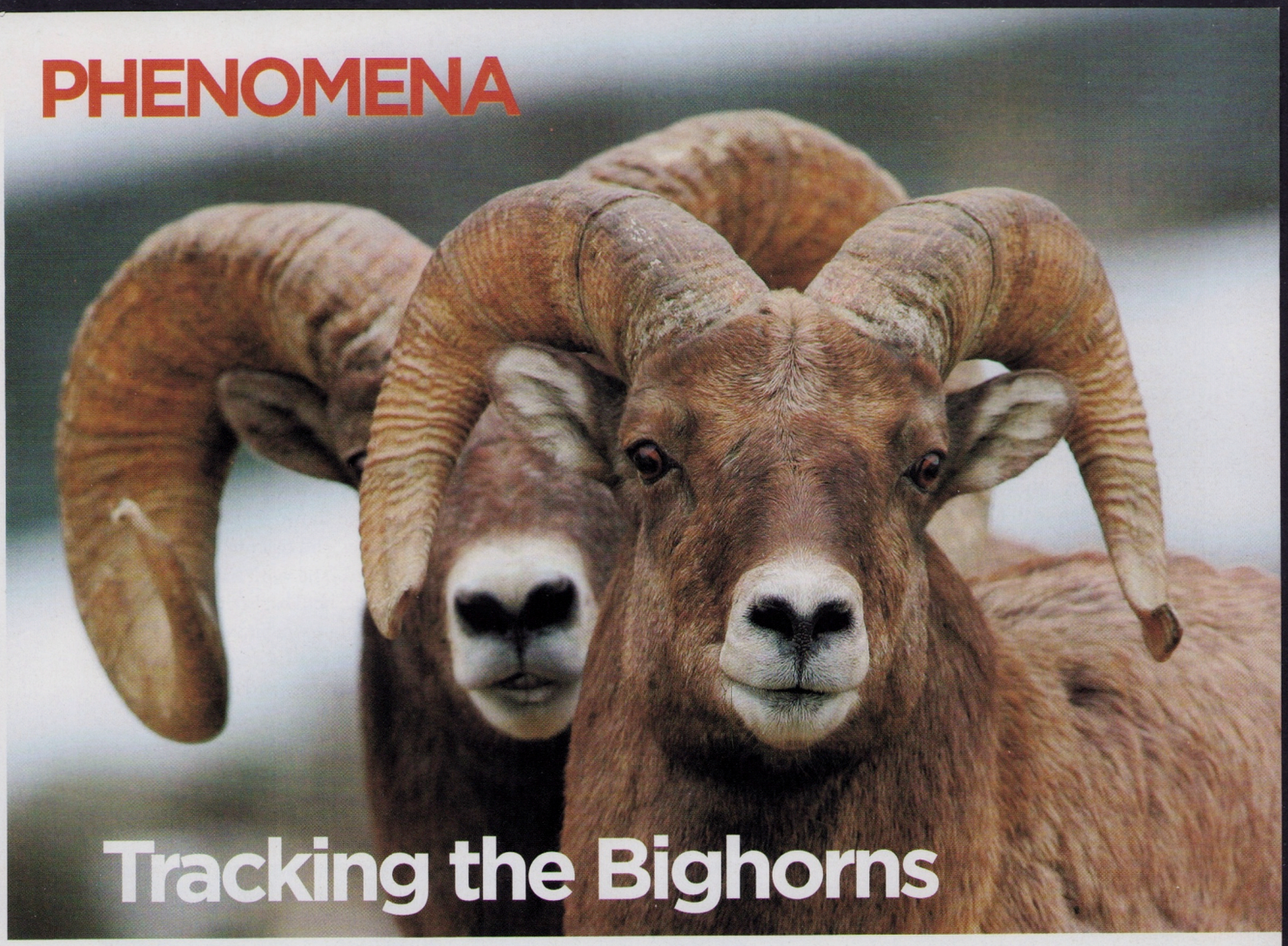

Tracking the Bighorns

Where do the elusive mountain climbers go? Researchers have finally learned some answers **BY BECKY LOMAX**

AS THE FIVE OF US hiked around Rising Wolf Mountain, a monolith of ice-chewed rock in the southeast corner of Glacier National Park, we could hear clinking and rattling somewhere in the talus slopes above us—miniature rock slides unleashed by hooves. Kim Keating, a wildlife biologist with the Northern Rocky Mountain Science Center in Bozeman, Montana, was in the lead. He has studied Glacier's bighorn sheep for two decades, collaring 99 since 2002 and tracking them with GPS recorders and radio telemetry. The tranquilizer dart he carried had enough of the narcotic carfentanil and the sedative xylazine to pacify a 300-pound sheep. Because the dose is lethal to humans, Keating—and only Keating—would handle the dart.

The low-angled autumn sun lit up yellowing larch trees like candles. Stephanie Schmitz—one of three fieldworkers assisting Keating—spotted a small herd of bighorn in a golden meadow up ahead. Keating loaded his dart rifle, then began edging toward the animals. They raised their heads. Keating stopped, pretending to be doing nothing. He sat down for a few minutes. "To avoid startling them, you want the sheep to see you," he explained later, "but you have to be willing to walk away if the shot isn't right."

The sheep dropped their heads to munch on grass. Keating crept into shooting range—20 yards away or less—aimed and fired. A few sheep ran; some stared, befuddled. A ewe staggered.

The crew's first job was to prevent the ewe from tumbling downhill. "If they get going, they'll roll to the bottom of the mountain," Keating said. Assistant Josh Brown blindfolded the groggy animal, holding her head erect by the horns. Keating collected a snip of hair, a vial of blood and a swab of saliva. He counted two growth rings on her horn: she was 2 1/2 years old. Collar number 118, affixed with a radio transmitter and a GPS recording unit, was cinched around her neck. Keating injected the ewe with a

D. ROBERT AND LORRI FRANZ

drug to bring her out of her stupor. After a few wobbly steps, she ambled off to join the herd.

Bighorn sheep, *Ovis canadensis*, are a majestic symbol of the mountainous West. They browse at high altitudes and in steep, rocky areas from Texas to British Columbia. Rams' horns curl around their eyes and grow up to 45 inches long. Males butt horns to establish dominance during the fall rut. Ewes sport shorter, spiked horns similar to a mountain goat's. From their first days of life, bighorns are sure-footed enough to scale cliffs too steep for most predators to follow.

Two centuries ago, an estimated 1.5 million to 2 million bighorn sheep lived in North America; today, a mere 28,000 remain. Diseases caught from domestic sheep, competition from livestock for forage, and trophy hunting for their horns caused populations to plummet. Bighorns graze in mountain meadows, habitat that is being lost to expanding forests, which are growing beyond their historic boundaries in part because the wildfires that used to hold them in check have been suppressed. Glacier National Park, home to 400 to 600 bighorn sheep, lists the animal as a "species of concern," that is, at risk of becoming endangered.

To protect bighorns, Keating says, we have to understand them better. That's his mission. Each battery-powered GPS unit records the animal's location every five hours for a year. Then, on a programmed day, the collar drops off; Keating must go find it. "Retrieving a collar with its 1,600 or more stored location points is like Christmas," Keating said. "You never know what you'll find."

In the past few years Keating's collars have recorded a great deal of new information about bighorn behavior in the park, including previously unknown wintering, rutting and lambing sites. The devices have shown that bighorns travel greater distances, up to 20 miles, and visit mineral licks more often than researchers realized. The work has also revealed just how sheep-like bighorns can be. That is, they're creatures of habit. "They seldom explore new habitat," Keating says. They travel to and from their ranges for wintering, lambing and browsing along paths used by the herd for generations.

NORTH OF RISING WOLF MOUNTAIN is one of the park's historic tourist hubs, called Many Glacier. Four valleys laced with glaciers and alpine lakes come together here. Bighorns are common in this part of the park, and wildlife

"National parks in general don't have good inventories" of wildlife, says Kim Keating (left: counting growth rings in a ewe's horns, with Josh Brown and Stephanie Schmitz). Now Glacier National Park's bighorns (top: a radio-collared ewe) are better understood.

BECKY LOMAX (2)

Newsletter

2015
December

Sierra Nevada Bighorn Sheep Foundation

Dedicated to the future of Sierra Nevada bighorn sheep

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Recovery Success and Disease Risk– a Double-Edged Sword

The past three years have seen major steps toward the recovery of Sierra Nevada bighorn sheep. In 2013, a 25-year hiatus in re-introducing Sierra bighorn into vacant historic habitat finally ended with the release of sheep at Olancha Peak. That was followed in 2014 with the initiation of the Big Arroyo herd–the first herd of Sierra bighorn to roam the Great Western Divide west of the Kern River in a century, and probably considerably longer. In early spring this year an attempt was made to expand sheep distribution in that Kern Recovery Unit by initiating the Laurel Creek herd immediately south of Big Arroyo. At the same time a new herd was initiated on the west side of the Cathedral Range in Yosemite National Park. Thus, four new herds were started in three years by moving sheep.

In this same time period the natural colonization of the Taboose herd (south of Big Pine in the Owens Valley) was confirmed. While rams had been regularly documented to use this area, it was only in the past couple of years that ewes began to be observed, but only one or two at a time. Attempts in recent years to find and capture at least one female via helicopter failed – until this past October when two were caught and collared.

Both received GPS collars that will elucidate seasonal habitat use patterns. This information will be used to determine when, where, and how adequate data on population size and composition might be obtained.

The presence of reproducing populations in the Olancha Peak, Laurel Creek, Big Arroyo, and Taboose Creek herds completes the distribution requirements listed in the Recovery Plan for Sierra bighorn. That is one of three requirements that need to be met for the U.S. Fish and Wildlife Service to consider downlisting Sierra bighorn to threatened and eventually removing them from the endangered species list (delisting). Timely achievement of such removals from the endangered species list should be the goal of all endangered species programs, but few find such success; Sierra bighorn are an exception in that such a goal is very much within reach.

What are the other goals for downlisting and delisting specified in the Recovery Plan? In addition to distribution, there are specified population levels within four geographic regions called Recovery Units. The total comes to 305 ewes by minimum count. Two of the Recovery Units (Southern and Central) have reached specified numbers. The Kern and Northern units both need more ewes. The Kern unit was vacant just two years ago; with any luck there will be steady population gains there, but it is expected that these fledgling herds will need to be augmented via releases of more bighorn. For years, the Northern Recovery Unit has struggled to maintain sheep numbers in its two small herds. The release of Sierra bighorn into the Cathedral Range in 2015 was, in part, an attempt to establish another herd in this region which, if successful, will add ewes to this Recovery Unit. Also accomplished in early spring 2015 was the initiation of another reproductive unit in the Northern Recovery Unit: the Alger Creek subpopulation of females at the southern end of the Mount Gibbs herd unit. The five ewes released there in 2015 served multiple purposes: they expanded female distribution in that herd unit, increased the number of females, and enhanced the genetic diversity. All five ewes were individually selected for their genetic diversity (high heterozygosity) and recaptured for this project. There is considerable evidence that population growth of the Mount Gibbs herd has been limited by low genetic diversity and inbreeding. This population declined to a reproductive base of only a single ewe in the mid 1990s and there has been inadequate movement of genes into this herd from other herds.

The third goal in the Recovery Plan for downlisting and delisting Sierra bighorn is the removal of threats of introduction of disease from domestic sheep and goats. From a long-term historical perspective, such disease has been the largest factor affecting Sierra bighorn, and bighorn sheep in general. As part of their normal respiratory tract flora, domestic sheep carry bacterial strains that cause fatal pneumonia in bighorn sheep. There is little question that it was repeated contact with domestic sheep that led to the loss of all but three bighorn herds in the central and southern Sierra. But those surviving herds also apparently went through repeated die-offs and show the scars of a turbulent population history in their substantially reduced genetic diversity.

Introduced pneumonia in Sierra bighorn is not just a threat of the past. Despite some recent decreases in that threat through the closure of some domestic sheep grazing allotments on nearby government lands following endangered listing, the threat remains very real in some locations. All it will take is contact with one domestic sheep or goat–a domestic straying into bighorn sheep habitat or a Sierra bighorn attracted to nearby domestics, e.g. ewes in estrous. In the spring of 2013, bighorn sheep biologists in California experienced a somber reality check on this issue when a population in the eastern Mojave Desert on lands managed by the National Park Service was discovered to be dying in large numbers from introduced pneumonia. This was a population that our president, John Wehausen, had been following closely since 1988, and which had served as the source of more than 200 sheep that had been caught and moved to fill in vacant habitat patches in that desert region. Subsequent research has found that a bacterial strain involved in this pneumonia outbreak had moved widely through that desert region, presumably via bighorn sheep moving between mountain ranges–behavior that

is well documented and genetically very important. One of the notable aspects of this disease outbreak is that it occurred in a remote location where it was not expected. The source of this disease remains a mystery.

Bighorn photos courtesy of Steve Yeager

A year ago we were able to report that the total population of Sierra bighorn had surpassed 600. Unfortunately, this notable success is a double edged sword. With more Sierra bighorn and greater distribution, there is more opportunity for contact with domestic livestock and the devastating consequences that would result. In recent years, movements of Sierra bighorn between herd units and the resulting gene flow have been well documented. That gene flow is essential to maintain what genetic diversity remains in these bighorn, but it also suggests the high likelihood that an introduced disease will spread from herd to herd in some regions.

In addition to increasing the distribution and numbers of Sierra bighorn, the third purpose for recent actions to establish new Sierra bighorn herds in the Kern Recovery Unit and in the Cathedral Range in Yosemite National Park has been to begin creating potential refuges where respiratory disease is least likely to occur. The Recovery Plan defined Recovery Units on the basis of greater isolation relative to spread of disease. While there are a number of known locations with domestic livestock in the vicinity of Sierra bighorn, the greatest threat currently occurs in the Northern Recovery Unit where domestic sheep are grazed for a period every year immediately adjacent to bighorn sheep habitat on lands administered by Mono County at the mouth of Lundy Canyon. Our Foundation has written multiple letters to Mono County in coordination with letters from other concerned agencies; but so far our collective elucidation of the extreme danger this poses has seen an entrenched resistance to removal of this threat.

Drought and Sierra bighorn

Predictions are for a wet El Niño winter in California in 2016, which would be welcome after three consecutive years of winter drought that ended with the driest winter on record.

It is typically assumed that drought is bad for wildlife because ecosystems are built on production of vegetation that is water dependent. How has the recent drought affected Sierra Nevada bighorn sheep? Because sheep are herbivores that are highly dependent on growth of new forage each year, it would be easy to assume they would have suffered in these recent drought years. In fact, however, the ecological relationships are considerably more complex, and Sierra bighorn have done well during these drought years. This complexity involves multiple factors, key among them being timing and source of precipitation.

Nutrient intake is critically important for wildlife in general and influences everything from reproductive success to population density. What limits nutrient intake for bighorn sheep is the nutritional quality of available forage. Put simply, green new plant growth early in the growing season has higher nutrient content than forage later in the growing season and especially in the non-growing season. Bighorn sheep are very selective feeders and choose the most nutritious bites from what is available. The nutrient quality of their diet is consequently determined by the amount of active plant growth in their habitat. Similar to plant growth in our gardens, growth of plants that bighorn might eat is limited by temperature, with the growing season occurring during warmer months. High mountains like the Sierra Nevada have a strong inverse relationship between temperature and elevation; lower elevations are warmer. In the Sierra Nevada, this means that the vegetation growing season begins at the lowest elevations in winter and works its way up the mountain, eventually reaching the alpine months later. Sierra bighorn know well about this relationship and many descend to lower elevation winter ranges in winter and early spring where they can tap into this earlier growing season and thereby increase their nutrient intake.

Not only do our gardens not grow when it is too cold, they also do not grow if the soil is too dry. Soil moisture also limits diet quality for bighorn sheep. Sierra bighorn live in desert environments which, by their nature, are water limited. Low elevation winter ranges are in the rain shadow of the Sierra Nevada along its eastern base where the habitat is Great Basin desert.

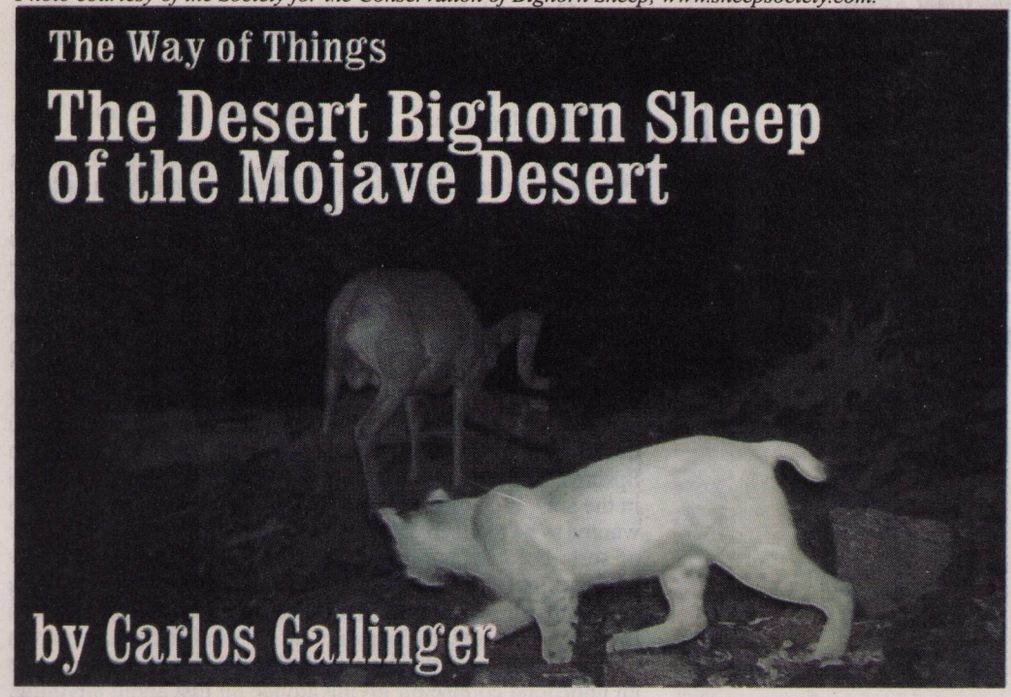
Alpine habitats in the Sierra Nevada also are deserts. During the brief season when temperatures are warm enough for plant growth, moisture from rainfall is unpredictable due to the Mediterranean climate of California. Consequently, alpine plants in the Sierra Nevada rely substantially on the melting of snow from the previous winter. Following winter droughts there is considerably less snow melt available to satisfy the summer thirst of alpine plants. In the absence of sufficient soil moisture, the alpine growing season will be shortened with negative consequences for bighorn sheep nutrient intake. However, winter storms are not the only source of moisture in these mountains. There are also summer thunderstorms from monsoonal moisture that moves in from various locations to the south, dropping rain equally on both sides of the Sierra crest, unlike winter storms from the Northwest. Summer moisture is very unpredictable, with summers varying from little to considerable monsoonal moisture. Each of the past three summers has seen considerable monsoonal summer moisture from storms that were particularly well distributed through those summers. That moisture has counteracted the lack of snow to maintain sufficient soil moisture and thereby has provided adequate diet quality for Sierra bighorn.

For Sierra bighorn that utilize low elevation winter ranges, there is a different relationship with precipitation in that habitat. Most plant species in low elevation desert habitats are adapted to grow in winter and spring, suspending growth during the hot season when adequate soil moisture is lacking. These species simply wait for the combination of adequate soil moisture and temperature to initiate plant growth that will provide a boost in diet quality for sheep. These species vary greatly in their adaptations to cold, from those that can initiate growth during winter, to those that wait until spring. What determines the start of this growing season is the appearance of adequate soil moisture. Following the first soaking rainstorm in fall or winter, the diet quality for Sierra bighorn feeding in this habitat increases steadily into early spring because of increasing availability of growing vegetation. The timing of this initiating storm can vary from October to early March depending on the year, leading to great year-to-year variation in nutrient availability on winter ranges. In each of the recent drought years there has been an early storm that has soaked winter ranges in the southern Owens Valley, leading to excellent nutrient availability for sheep feeding there in winter and early spring.

Why doesn't the amount of winter precipitation limit plant growth and bighorn diet quality in this desert habitat? Relatively cool temperatures in winter and early spring conserve soil moisture and allow plants to continue growing fully, even in drought years. Most Sierra bighorn have left low elevation winter ranges for higher elevations before the amount of winter precipitation begins to limit plant growth on those winter ranges later in spring. Consequently, the timing of the first soaking storm largely sets the level of nutrient availability for Sierra bighorn utilizing low elevation winter ranges.

Not all Sierra bighorn utilize low elevation winter ranges. Some live year-round in the alpine by feeding in winter on ridges and slopes cleared of snow by wind. For these sheep, winter drought has meant great freedom in where they can feed throughout winter – a freedom that can be expected to translate to better nutrient intake. Additionally, few winter storms translates to few days of extreme wind chill and white-out conditions during which Sierra bighorn living up high undoubtedly tap more into fat reserves to survive. In short, because of these details of how weather interacts with the ecology of Sierra bighorn, the recent years of extreme winter drought have not had an apparent negative effect on these bighorn.

Photo courtesy of the Society for the Conservation of Bighorn Sheep, www.sheepsociety.com.



The Way of Things

The Desert Bighorn Sheep of the Mojave Desert

by Carlos Gallinger

The desert's bighorn sheep are one of the very unique species we have in the Mojave Desert. They're the desert's largest inhabitants, but there is much more to the species than just their size. If you have been fortunate enough to witness a large ram scurry up a an impassable mountain side, then you know what I mean.

Some years ago, while hiking in a local mountain range, I found a dead ram. A short time later I had found yet another dead ram. It was from that point forward that I began searching this mountain range for bighorn sheep. While I learned a lot by tracking and following game trails, it took me almost six years to see a living bighorn sheep in this range. The difference between those early years and now is knowledge. Knowledge not only of this particular mountain range, but of desert bighorn sheep in general. In my years, I've found that some of the sheep's behaviors are quite amazing and difficult to believe at first. It is also these behaviors that make them so difficult to find.

One unique characteristic of the bighorn sheep is their ability to survive without water for an extended period of time. When the desert has received a fresh supply of precipitation and the temperatures are cooler, bighorn sheep can survive for months without drinking water. However, in the driest and hottest times, they still must drink almost daily. While that may not seem to be a long time, try to survive without water for a day or two in the desert, in August, and you will see what I mean. When sheep do go in search of water, they employ amazing strategies to get in and get out safely.

In California, bighorn sheep live as high as 12-13,000 feet in elevation, as they do in the White Mountains, or as low as 200-300 feet in places like the Chocolate Mountains. Some make their homes in the forest like those in the San Gorgonio wilderness. It is the extraordinary ability to adapt to a variety of often extreme conditions that make them so fascinating.

By following sheep in their daily lives I've learned a lot more than just how they survive in the desert. To learn about sheep, one must also learn about the desert in its entirety.

For example, sheep often have a very strong bond to their herd and once, while in the Mojave Desert, I saw an example of this bond and was quite amazed.

I happened to be riding down a wash on a motorcycle when I saw a mountain lion run right in front of me and proceed to my right. It was getting late and the sun had begun to set. I stopped to watch the lion for awhile and after he reached the top of a small hill, he stopped and watched me. After just a few short minutes, I started to take off and it was at that moment I glanced down to see a dead Bighorn Sheep.

It was a full grown ewe that had just been killed and recently enough that the mountain lion had not started eating it. I gazed at it for a few moments and continued home. Intrigued by the kill, I devised a plan for further investigation once daylight returned.

Early the following morning I arrived at the location of the dead ewe and settled in about 500 yards away with some high powered binoculars and a spotting scope. Suspecting the mountain lion had probably had the ewe for dinner the night prior, I was hoping to catch another glimpse of the lion somewhere in the vicinity. The sun rose and an hour passed. Nothing.

Then, to my surprise, out of nowhere a group of ewes were slowly making their way down the wash. Using my 20 power binoculars with an 80 mm lens, I was able to view the sheep very well. The sheep appeared a bit nervous as they were making their way down the wash and were moving toward me at a cautious pace. I wondered if the dead ewe belonged to this herd or if it happened to be a coincidence they were in the area. The answer became more evident as they got closer and closer.

This particular group of ewes numbered about eight to 10. As they closed to within 30 yards of the dead ewe, the herd bunched up, as sheep often do in times of danger. After another few moments, nervously, two left the group. One appeared to be a much older ewe and the other much younger, perhaps this year's lamb. They walked very carefully up to the dead ewe and looked at her for a minute or two. Then, they turned around and walked back to the group that had been patiently waiting then proceeded back up the mountain, at a somewhat hurried pace.

To my surprise, the horrendous death and terror the mountain lion had inflicted didn't stop the sheep from checking up on one of their own. When the herd discovered there was nothing that could be done to save the deceased ewe, they simply walked off. Once the herd departed, I walked up to the kill site to find that that lion had fed well the night before.

And this…is just The Way of Things in the desert.

I hope you have enjoyed reading my experience. If you would like to learn more about the desert and the desert's bighorn sheep, I welcome you to visit my website: www.thewayofthings.org.

Find out what happened between the ram and the bobcat in the photo above in our next issue!

DFG wants to land helicopters in wilderness

Proposal part of effort to help recovery of bighorn sheep population

10-13-2011

Register Staff

The Inyo National Forest is asking the public to comment on a proposal to use helicopters to monitor and, if needed, transport Sierra Nevada bighorn sheep. Photo by Stephen Ingram

The local branch of the Forest Service is looking at using helicopters to fly bighorn sheep around the Sierra. These flights would not be part of any sightseeing adventures for the curved-horn herbivores, but rather an effort to better monitor and relocate the sheep, if necessary, per a recovery plan.

The Inyo National Forest is currently accepting public comment on the proposal through early November.

The INF has prepared an Environmental Assessment for a proposal to authorize the California Department of Fish and Game to land helicopters in designated wilderness to support the recovery of the endangered Sierra Nevada bighorn sheep. The EA became available Oct. 11 for a 30-day public review and comment period.

According to the INF, the purpose of the project is to support DFG in implementation of the 2007 Sierra Nevada Bighorn Sheep Recovery Plan, which identifies specific actions needed to downlist or delist the species. Under the proposal, helicopter landings would be authorized in designated wilderness for the purposes of conducting population monitoring and translocation captures of Sierra Nevada bighorn sheep.

Proposed helicopter captures would occur in portions of the Hoover, Ansel Adams, John Muir, Golden Trout and South Sierra Wildernesses. The project would consist of a maximum of 100 helicopter landings per year, with no more than 605 landings over a 10-year period.

Copies of the EA can be obtained from the Inyo National Forest Supervisor's Office at 351 Pacu Ln. in Bishop or on the Inyo National Forest website at http://www.fs.fed.us/nepa/fs-usda-pop.php/?project=35211.

The comment period ends 30 days following the date of publication of the legal notice in the Oct. 11 edition of *The Inyo Register*.

Comments must be submitted to Leeann Murphy, Wildlife Biologist/Project Manager, 351 Pacu Ln. Suite 200, Bishop, CA 93514, or fax (760) 873-2458. Comments can be made directly on the project website at http://www.fs.fed.us/nepa/fs-usda-pop.php/?project=35211 by clicking on the "Comment on Project" button on the right hand side of the screen. Comments may also be submitted via e-mail to comments-pacificsouthwest-inyo@fs.fed.us, or hand-delivered weekdays 8 a.m.-4:30 p.m. at the above stated address.

For more information, contact Leeann Murphy at (760) 873-2450.

California BIG GAME HUNTING 2012

Apply NOW for your hunting Adventure!

Drawing Application Deadline is June 2, 2012

New Fund-raising Drawing Opportunities

page 72

Online Harvest Reporting Coming Soon

2012 LICENSES AVAILABLE April 15, 2012

THE LUCK

by Regina Abella

Hunters know too well the excitement of the Big Game Drawing. The familiar sounds of crinkling envelopes as you open a letter from CDFW, or the clicking of the keyboard as you log on to find out if you've been drawn for a big game tag. There is nothing quite like the sounds of the Big Game Drawing to get your heart pumping.

And so it was on a typical afternoon, Brigitte Mullen logged onto CDFW's ALDS system to check the Big Game Drawing. As she read through the short list of applications under the column labeled, "Did I Win," much to her excitement was a "Yes" to the bighorn sheep fund-raising random drawing tag. Not only would she get the hunting opportunity of a lifetime, but San Gorgonio Outfitters had offered her a free guide services to go along with it, "We couldn't have donated this hunt to a more cheerful and kind person than Brigitte," said Terry Anderson of San Gorgonio Outfitters.

After sharing the news with her husband and letting it sink in, Brigitte called her father to share the great news. As a bighorn sheep hunter himself, no one could be more excited for Brigitte to start her hunt. They say good news travels fast and it didn't take long for Brigitte's phone to start ringing, "Everyone was so wonderful and happy for me," Brigitte said. All excitement aside, Brigitte began to prepare for the hunt of a lifetime.

Her dad had hunted bighorn sheep and Brigitte was aware of the physical demands of the hunt and prepared to get in sheep shape. Regular exercise and long range target practice would occupy her schedule until her hunt in November. She spent time organizing the gear she would need for her hunt, and talking to her guide non-stop, "I probably called Terry 50 times!" Brigitte said. A scouting trip in September allowed her to familiarize herself with the zone, see some rams and sweat in the Mojave Desert sun, "It was hot!" she remembered.

After flying in to a Southern California airport, Brigitte, her husband and her brother made their way to sheep camp arriving at 2:30 am on a November morning, and awoke only a few hours later to start the hunt. Brigitte recalls the final haul to get into position for her shot, "We split up into groups to search for rams and I stayed with Andrew, one of the guides," said Brigitte. After locating a group of rams, and knowing they only had so much time before sundown Brigitte began her pursuit, "We almost ran up the side of the mountain, it was tough but so exciting that we just did it."

Brigitte picked her ram out of the group and made a successful 275 yard shot! The backdrop to her amazing shot was the sinking desert sun, "It was one of the most beautiful days I've had hunting." They group caped and quartered under the stars and headed back. "We were exhausted! It was back to camp, dinner and crash." Brigitte regaled, "It's not the biggest ram, but I love it and it's the most beautiful ram to me."

Some people might say Brigitte is just lucky, lucky to get drawn, to hunt, to see sheep and make the shot. To me, I'm reminded by a quote my dad shared with me by a Roman philosopher, "Luck is where the crossroads of opportunity and preparation meet." When the opportunity finally met Brigitte, she was prepared. How will you prepare for your hunts this year?

of THE DRAW

The desert bighorn ranges through the dry, desert mountains of eastern California, much of Nevada, northwestern Arizona and southern Utah, according to the National Parks Service. Researchers estimate the total population at about 13,000.

Along a Far HORIZON

Encounter with desert bighorn sheep in the Sespe Wilderness means herd once thought lost may be reviving.

The cliff face rose more than 1,000 feet from the canyon floor to a distinct V-notch just below the rolling ridgeline. Scrambling up an alluvial fan of crumbly, loose shale, I made my ascent toward the notch and into the heart of desert bighorn sheep (*Ovis canadensis nelsoni*) habitat deep in the Sespe Wilderness.

Here, the land is harsh and unforgiving, and even though it is part of the U.S. Forest Service, it's described by some as bleak and jagged, filled with sandstone cliffs that reach high above the desert floor.

The previous day, fellow hiker Danny Trudeau and I had covered 15 dusty miles and were ready to stop. We were looking for a reliable water source close to our camp. Just as the last of a winter sun dipped beyond the daunting Topa Topa Mountains to the west, we came across a spring in a narrow canyon beneath a cottonwood tree. We hadn't seen anything out of the ordinary in terms of wildlife on our hike, but the Sespe Wilderness is home to deer, mountain lions, black bears, coyotes, bobcats, rattlesnakes, Red-tailed hawks and golden eagles. We took note of the spring location and then headed back to our tents when movement in the distance caught Trudeau's attention.

"There's some bighorn up on the ridge above us," he said, pointing in that direction. At dusk and nearly 2,000 feet above us we caught our first glimpse of 13 nimble-footed bighorn sheep traversing eastward toward a craggy ridgeline ensconced in manzanita and sage.

I couldn't help but think we'd found what we'd come for.

Story by Chuck Graham

Bighorn Scramble

Desert bighorn sheep are found in seven western states including Texas, New Mexico, Arizona, Nevada, Colorado, Utah and California. Over the past century populations have declined by up to 90 percent, according to the advocacy group Los Padres Forest Watch. The group is a steward of the Los Padres National Forest and the Sespe Wilderness lies within the forest. The wilderness lies within the Western Transverse Range, and is the westernmost range for desert bighorn sheep in the western U.S.

According to the California Department of Fish and Wildlife, desert bighorn sheep in California have seen a large amount of extirpation over the past 100 years. Threats to habitat include vegetation succession, loss of water sources and fragmentation. Bighorn sheep have little resistance to the diseases of European sheep and cattle, and the grazing habits of free-roaming livestock reduce reliable food sources. Other threats include predation and human development. And yet another threat to consider is the overall affect of climate change—especially in lower elevations—due to higher temperatures and the resulting decrease in rainfall.

Even for the wildlife experts with CDFW, it's anyone's guess as to how many desert bighorn sheep reside in the Sespe Wilderness. It's a question that has lingered for decades. It started in 1985 and 1987, when the department had made a commitment to bring desert bighorn back to its historic range with a reintroduced herd of 37 bighorn that came from the San Gabriel Mountains 60 miles east of the Sespe. That herd was supposed to reestablish desert bighorn in this region for the first time since 1914.

After releasing the reintroduced herd, those transplanted animals ran into several obstacles almost immediately. Powerful wind storms scattered the bewildered bighorn. That region of the Sespe was also overgrown with vegetation, 20-feet-tall in some areas, forcing the bighorn to run blindly into waiting predators, mainly mountain lions. It also didn't allow for new growth of grasses and sages vital for their browsing.

At the time, CDFW fitted the reintroduced bighorn with radio collars. But nothing lasts forever, and by 1995, whether due to dead batteries or predation, those radio collars fell silent.

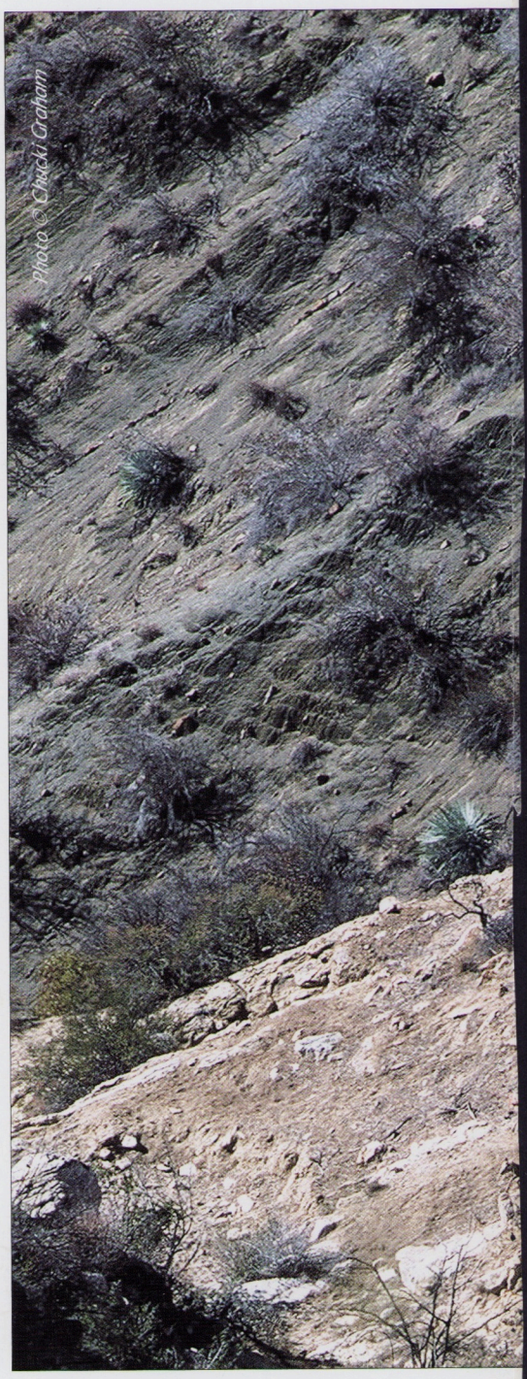
Land surveys by CDFW environmental scientists and volunteers were difficult due to the region's rugged terrain. In many places, the overgrown chaparral that hindered the bighorn's sight also frustrated the researchers. Aerial surveys were limited to outside the California condor sanctuary where good habitat existed. As years passed, surveyors were finding fewer sheep, often with only one or two bighorn turning up per survey. Eventually surveys came to a halt in 1992, when the last one produced only two sheep. At the same time, the San Gabriel sheep population crashed from about 700 to only 35. This shifted conservation focus away from the Sespe bighorn, causing the herd to somewhat fade into memory and take a backseat to the remaining San Gabriel animals.

"Initially, we expected a high mortality rate from predation," said Steve Torres, CDFW Wildlife Investigations Labortory supervisor. "There's no surefire way to move animals successfully, and there are lots of risks involved. To get a viable herd established is quite a masterful process."

However, by 1999, reports by backpackers and hunters were filtering in about bighorn sightings at the higher elevations of San Rafael, MacDonald and Cobblestone Peaks, all still in the Sespe Wilderness. Sightings of up to 28 sheep restarted surveys but bighorn numbers didn't climb beyond that.

Day Fire

Desert bighorn sheep have endured a lot in the Sespe Wilderness. The combination of overhunting and disease from livestock took its toll and drove them to the brink of extinction by 1914. After the emergence of the reintroduced herd in the 1990s, the bighorn population in the Sespe was in a wait and see mode due to the overgrown chaparral. It took an act of nature to kick start everything. Fires are essential to the survival of desert bighorn sheep. Southern California's Day Fire in 2006 took care of that. One of the state's largest wildfires, the Day Fire began on Labor Day and wasn't contained until Oct. 2. More than 4,000 firefighters fought the blaze. It had been started accidentally by



someone burning trash. The 254-square-mile fire cost over $73 million to fight, and burned 162,702 acres.

But despite the devastation, the wildfire produced two positive effects in the Sespe. It burned overgrown chaparral that wasn't allowing new vegetation to grow beneath its dense canopy. And it opened up valuable escape terrain for the (still-undetermined) population of desert bighorn sheep in the region.

"In principle, bighorn sheep in these

Across harsh and unforgiving desert managed by the U.S. Forest Service, the author saw signs that a reintroduced herd of desert bighorn sheep had made progress in the Sespe Wilderness. Above, more than a dozen bighorn sheep scramble eastward across the open land toward a craggy ridgeline ensconced in manzanita and sage.

During the hottest periods of the day, bighorn rest, often on cliffs or steep terrain above their water source. Rest periods are also used for chewing cud. Desert bighorn sheep browse and graze on grasses, cacti and sage. Next page, it was the destructive force of 2006's Day Fire that may have played an unexpected role in helping the struggling desert bighorn in the Sespe Wilderness bounce back. The wildfire ran over 254 square miles and burned 162,702 acres. But what it did was cleared out much of the thick vegetation across the Sespe Wilderness, and opened up the area for new growth.

California Hosts 2015 Desert Bighorn Council

The California Department of Fish and Wildlife will serve as the host of the 2015 meeting of the Desert Bighorn Council. The council will meet in Borrego Springs in April. This biennial meeting brings together wildlife biologists, scientists, administrators, managers and others interested in the welfare of desert bighorn from seven western states (Texas, New Mexico, Colorado, Arizona, Nevada, Utah and California) to exchange information, present research and take action on desert bighorn management.

Dr. Ben Gonzales, senior wildlife veterinarian at CDFW's Wildlife Investigations Lab will lead the council. The program Chair is Steve Torres, environmental program manager at the Wildlife Investigations Lab. Mark Jorgensen, former superintendent of Anza Borrego Desert State Park will serve as local arrangements chair.

For more information view the website, *www.desertbighorncouncil.org/about.html.*

coastal scrubs, vegetation communities benefit from fire," said Torres. "It provides more open habitat and forage, and provides better visibility to avoid predators."

The burn has already enabled survey crews to get a better read on the existing population. A survey in November 2012 revealed the largest number of bighorn ever seen since the initial reintroduction in the 1980s. A total of 64 sheep looked healthy and were thriving from the wide open terrain and new growth. The survey was conducted by CDFW experts and volunteers using the Los Padres Outfitters to carry supplies on mule pack trains.

CDFW Environmental Scientist Christine Thompson was part of the team and she said the band of bighorn still needs plenty of observation. Her goal is to attach GPS collars to some and collect data on their movements.

"The Sespe Sheep are a big unknown," Thompson explained. "That's why I want to get collars on some of them. We want to know where their lambing areas are. Are they moving or staying in one place?"

Typically, peak lambing season is February through March, but it can occur from mid-December through May, depending on the health of the habitat. In December, there came word that a lamb was spotted.

"We don't know when these bighorn are dropping lambs," Thompson said. "I'd like to do bighorn land surveys at MacDonald and Cobblestone peaks. I conducted a fixed-wing flight over those areas and saw some trailing."

Counting Sheep

However, last summer I'd heard rumblings that the small band of desert bighorn was actually hovering at the century mark.

Graham Goodfield is the owner and primary guide for Los Padres Outfitters, a Santa Barbara-based mountain guide service with horseback expeditions. Goodfield has spent most of his life exploring the backcountry of the Los Padres National Forest and he has been instrumental in leading land survey crews into the Sespe Wilderness to look for bighorn. He's counted sheep during many of his trips, and believes healthy bighorn are back there.

"I'm up to 128 sheep," said Goodfield over the phone earlier this year. "I found many of them in the high country behind Willett Hot Springs."

It may have been that conversation that convinced me to seek out and view the recovery for myself. My fellow hiker Trudeau and I had parked our car miles away and then hiked in. After spotting those 13 bighorn above the spring just as the sun went down, the air turned cold and we returned to camp. The next morning, I headed out at dawn, determined to find the herd.

I scrambled and thrashed my way toward San Rafael Peak at nearly 6,600 feet elevation. Along my way I found plenty of trailing and droppings. Visibility was excellent as I scanned ridgelines searching for sheep. However, they blend in so well in their environment I was having no luck locating them and the venture was beginning to look like a bust. That was until I heard rocks cascading into one of the few creeks still holding water.

Below me in a narrow draw I counted a dozen desert bighorn sheep. They moved upward on a loose scree slope. Several ewes and lambs stayed close to a large ram that possessed impressive curled horns. The horns on the tiniest of the lambs were just beginning to pop. I watched from above as they traversed the west face to a narrow ridgeline, feeding the entire way.

One of the more intriguing questions surrounding these bighorn is their ages and how many generations of bighorn have lived in the Sespe Wilderness since the reintroduction. Thompson said desert bighorn rams typically don't live as long as the ewes. Males live 10 to 13 years, where the females live a bit longer, 12 to 20 years.

"So we're looking at third or fourth generation sheep in the Sespe," said Thompson.

Another aspect surrounding the Sespe bighorn was observing a couple of herds with at least two large rams. That first herd of bighorn that Trudeau and I saw on the ridgeline at dusk revealed at least two large rams in the herd. This may be another need for collaring some of these bighorn to learn behavioral traits that possibly evolved while surviving in such dense vegetation.

"Rams are usually solitary," Thompson said. "But the Sespe bighorn may have structured themselves where there are more than one ram per herd."

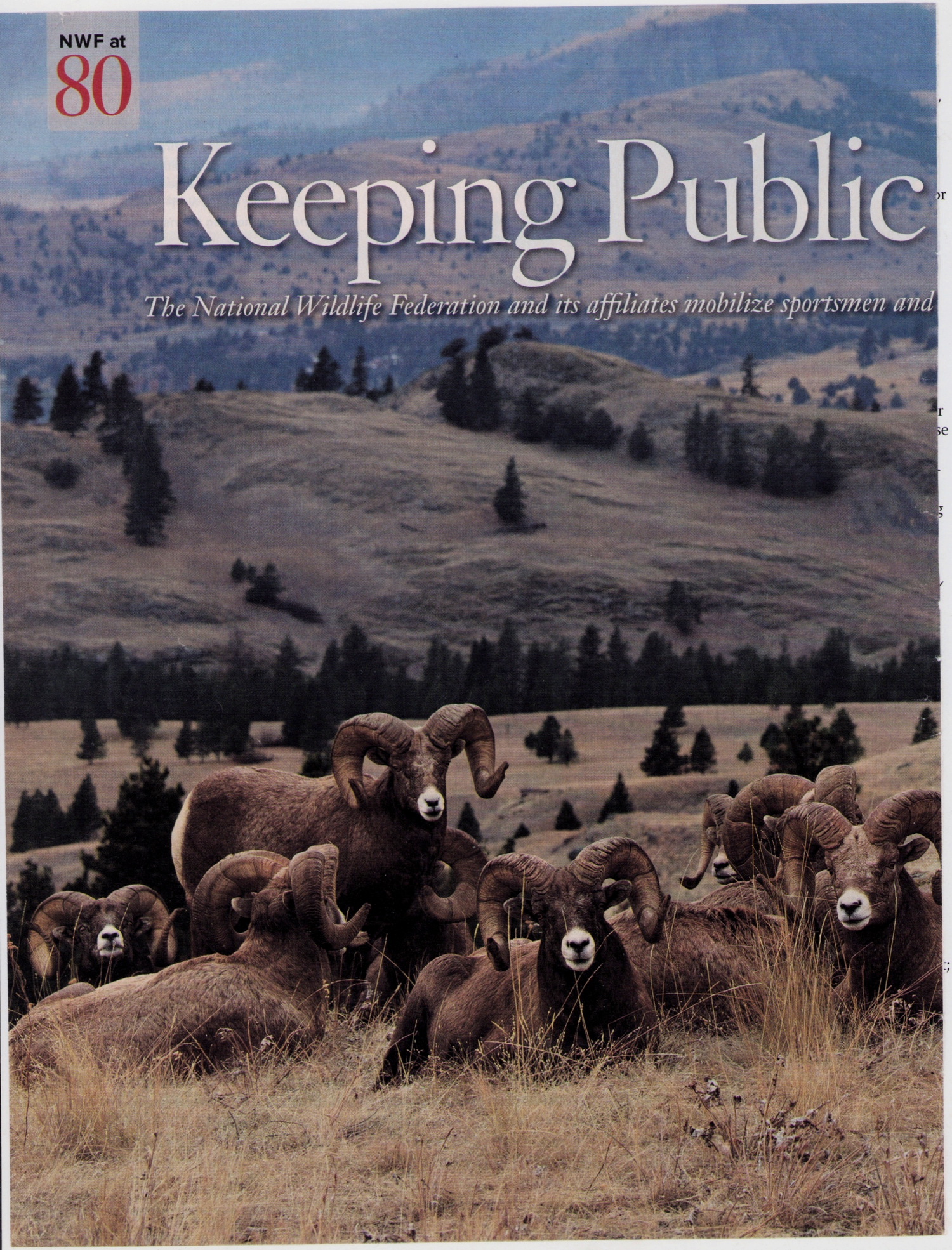
Before I stopped and returned to our camp, I scrambled up and down two more canyons. At the top of the second one I looked down on top of a plateau hundreds of feet from where I stood. There was a blur of desert bighorn running hard and heading west. I counted 20 animals before they were out of my line of sight. For a moment I thought maybe they were being chased, but I never saw a predator in hot pursuit. All I could see across the Sespe Wilderness was plenty of wide open space for these bighorn to roam.

Chuck Graham is a freelance writer and photographer living in Carpinteria. His articles have appeared before in Outdoor California.

NWF at 80

Keeping Public

The National Wildlife Federation and its affiliates mobilize sportsmen and

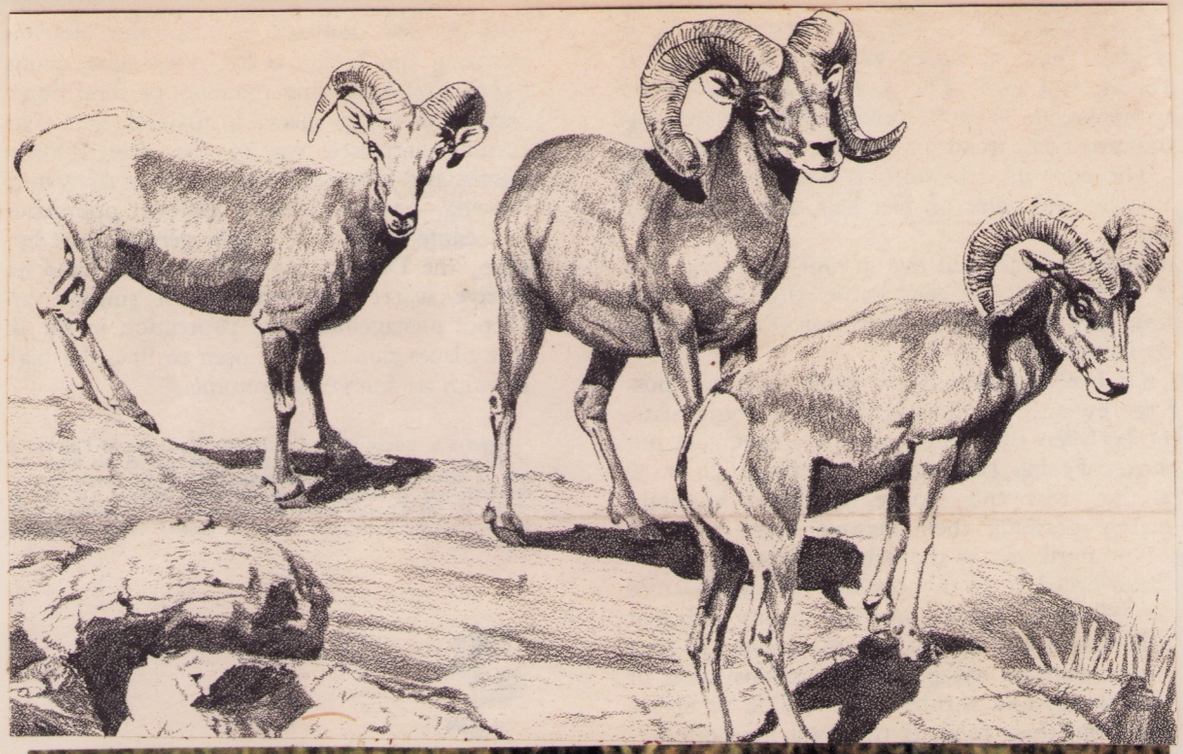


Lands Public

other outdoor enthusiasts to fight state efforts to seize public lands

Bighorn sheep rest on public lands in Montana, where the legislature tried—and failed—to get such lands handed over to the state. The move could have limited access to sportsmen, hikers, birders and other visitors.

PHOTO: DONALD M. JONES (MINDEN PICTURES)



The well-turned headgear *of Dall sheep makes them prized trophies for hunters*

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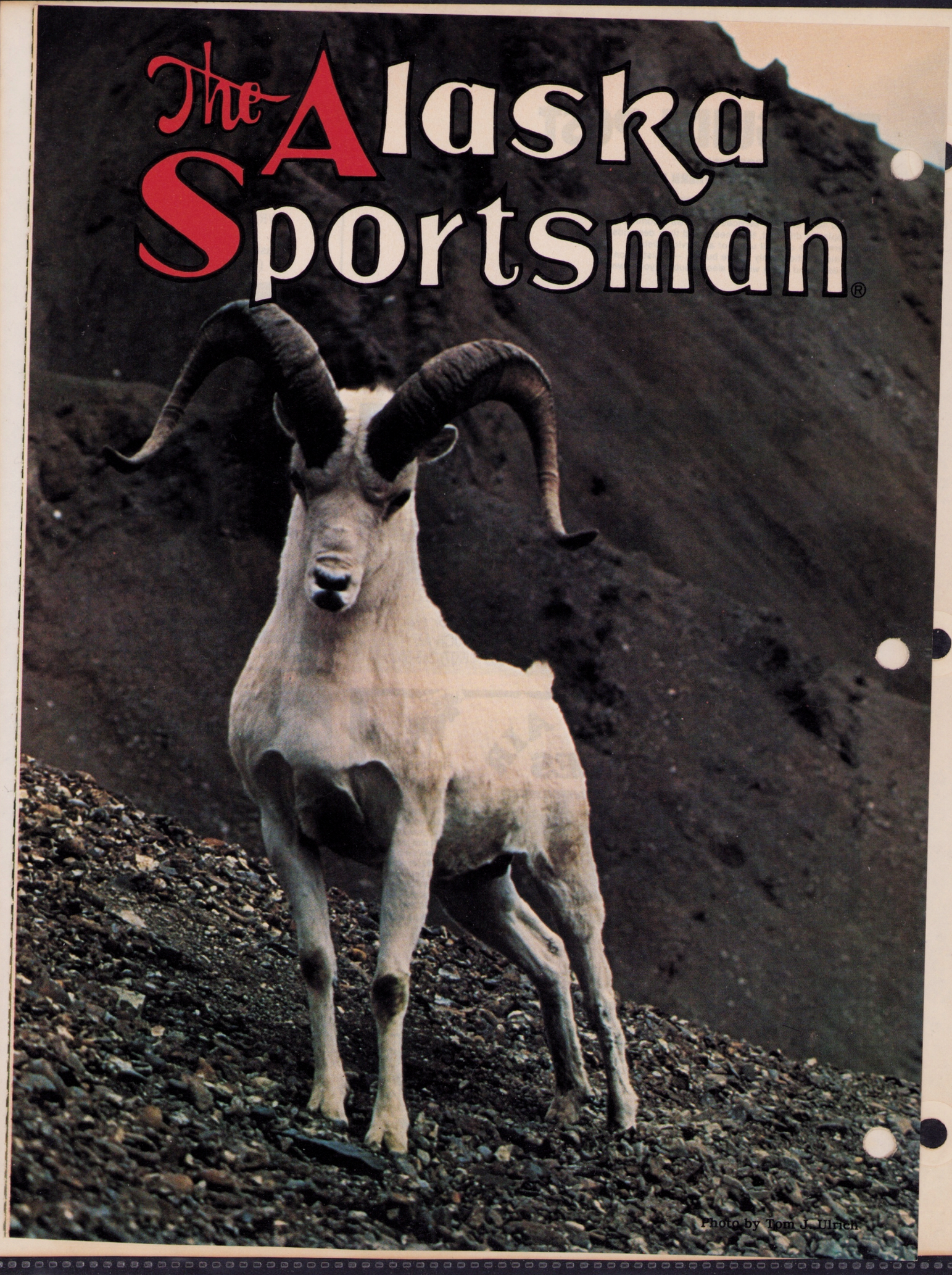


Photo by Tom J. Ulrich

BIGHORN SHEEP

BIGHORN SHEEP

Jane Kim's 'Migrating Mural' brings bighorn sheep into focus

Rarely seen in the mountains, the bighorns are now in plain view ... on the surfaces of Eastside structures

Muralist Jane Kim

Story and photos by **Leslie Willoughby**

A few days after San Francisco artist Jane Kim received $27,760 toward her Migrating Mural project, she packed her paints and headed for the Mt. Williamson Motel in Independence.

On a blazing, brilliant, Eastern Sierra October morning, she clambered up bright yellow scaffolding at the motel and began to create two building-sized murals of endangered Sierra Nevada bighorn sheep.

Kim planned to complete that first stage of her Migrating Mural project by Thanksgiving, and then move on to paint more bighorns at Gus's Really Good Fresh Jerky, in Olancha, and the Bishop Gun Club outside Bishop. She proposed additional murals for sites in downtown Bishop, Mammoth Lakes, and the Mono Basin. All paintings of her Migrating Mural project are on track for completion this year.

"Through the murals, the transient life of these animals can easily be seen and more importantly, appreciated ... I hope to connect people to animals that have kept our planet in balance for millions of years—the type of lasting connection that will help protect them from disappearing forever," said the thirty-one-year-old Kim.

With endorsements for the bighorn sheep murals from The California Department of Fish and Game and The Sierra Nevada Bighorn Sheep Foundation, Kim has set her crosshairs on realizing a greater vision: to depict the migrations of endangered species throughout North America.

But right here, right now, at the launch of what may become an international project, it seems wise to wonder whether this is a good thing for the Eastern Sierra.

Lots of people seem to think so, including the four hundred, fifty-three backers that Kim attracted to Kickstarter (an online funding platform for creative projects) during October.

But most of those donors will not get to look at the murals every day, as will others who live on the Eastside. Billboards are outlawed in Mono County, and the U.S. 395 corridor between Fossil Falls and Topaz Lake has been designated the Eastern Sierra Scenic Byway. Some perceive the Migrating Mural as an enhancement, while others perceive the project as a potential blight on the pristine outdoors.

Alexandra Few, a wildlife biologist for the California Department of Fish and Game's Sierra Nevada Bighorn Sheep Recovery Program, said of their endorsement, "We think it is an outstanding opportunity to raise awareness and create support for our conservation efforts. [The sheep are] hard to see; there are not that many of them and even if you are looking at them they are not that easy to see."

Only wilderness backpackers are likely to see any of the four-hundred living, well-camouflaged animals, but Few said that Kim's life-like murals would bring an awareness of the high-elevation sheep "down to [U.S.] 395."

Recovery workers "met Jane through a recommendation from a park biologist through Yosemite," said Few. "We were looking for someone to help us design our website to make it more visually appealing. So we got to know her work through those efforts."

In the end, they got to know more about Kim than her work, including, Few said, her "personality and her enthusiasm and energy and also her skill as an artist and a scientific illustrator," said Few.

"I feel really lucky in bringing that quality of her artwork to the Eastern Sierra. This brings a little bit of science—

The Bighorn Sheep as painted by Jane Kim

she pays attention to the expressions on bighorn sheep faces."

The Sierra Nevada bighorn sheep subspecies, with their distinguishing wide horn flare, are not your ordinary bighorn sheep," Few said.

"In the White Mountains, you can see desert bighorn, and visitors walk away feeling they have seen bighorn sheep, but the desert bighorn is a different subspecies and is not endangered.

"In the long term we're hoping that these murals can act as a nucleus to bring the community together for the purpose of conservation."

Tom Stephenson, Program Leader for the recovery project, spoke via mobile phone from the field where he, John Wehausen (President of the Sierra Nevada Bighorn Sheep Foundation), and Kim were attempting to capture and collar the sheep.

Stephenson said this was time of the year when "we've got mating occurring, rams traveling around in search of ewes to breed with, the time of year when you have the spectacular behavior with the horns clashing, establishing their dominance—if you happen to be in a canyon where the sheep are, it sounds like a gun going off."

Kim said she envisions painting murals that feature animals that migrate, and bighorn sheep qualify in two ways; they migrate through elevation as well as cross-country. In the autumn, the sheep's migration is elevational.

"We've learned some really interesting things by putting GPS collars on sheep during recent years," said Stephenson. "Certainly some sheep are very predictable: they spend summers in alpine and move into winter range sometime during the first of the year.

"Others we see test the forage conditions at thirteen thousand feet, then drop down to six thousand feet in one day (presumably to see what the forage conditions are like) and next day they are back up there."

One objective of the bighorn sheep recovery effort overlaps with that of the Sierra Nevada Bighorn Sheep Foundation, according to Wehausen, President of the Board and founding member of the foundation. Both organizations call for public outreach to help the public to understand the value of increasing the sheep's presence in the Sierra.

Outreach is "something we have talked about but don't do much about," he said. "Jane Kim takes care of outreach not just in a beautiful, artistic way," but in a way that helps the public to become "aware, interested, informed. [She] comes in and helps us to do a better job."

In the realm of education, Kim's traveling mural project has been valuable, said Leslie Dawson, education coordinator for Valentine Reserve and the Sierra Nevada Aquatic Research Lab (SNARL).

"Jane Kim's bighorn sheep Migrating Mural project ties in with the outreach mission of the University of California. We both are trying to interest people in our native wildlife, and preservation of their habitat. Jane's work is massive; environmental in scale, it uses existing outdoor settings and it accurately depicts the species and their habitat."

Several local businesses will most likely experience the greatest impact of the Migrating Mural project: the ones that accept or reject Kim's proposals to host a mural. Henriette and Paul Kenn, co-owners of the Mount Williamson Motel, were to be the first hosts.

They said they like the idea of preserving the sheep.

"It's a proud animal," said Henriette. "One time we saw a herd—three or four of them—but that was thirty years ago. It's still in our minds. We miss seeing them; they should be preserved."

"Once they're gone," Paul said, "they're gone."

"They have always been there since before we came. We are a motel here and a lot of people are going to ask about the murals."

Henriette said that people from across America and around the world find themselves seated at her and Paul's breakfast table. Given the joyful enthusiasm with which she discussed the sheep, it seems likely that visitors' questions will receive energetic replies.

Karen Schwartz, owner of Sage to Summit in Bishop, expressed eagerness to support the Migrating Murals with a bike race between the murals, upon the completion of the Eastern Sierra project next autumn.

"The bike race is definitely Jane's idea," Schwartz said. "I think it's a great idea, a really neat way to raise money for the Foundation by biking from mural to mural. I would most likely help facilitate with my event management experience.

"The biggest role is to make sure that all the murals get adequate funding. She hasn't even tapped into this local community to her help with fundraising.

After she has finished this first mural at the hotel, the Migrating Mural videographer and photographer could display their work.

"I'd be honored if she did it on this building, a fifth mural," said Schwartz. "Why not bring that celebration that people—who only get into the mountains sometimes—seek? They could see it here, with beautiful art."

When Kim proposed to paint a mural on a closed-down service station in Cartago, Daniel Hardwick, the building's owner, had two objections.

"I've had a lot of graffiti down there at my place and I know that's the first thing they do," said Hardwick. "Even when I was in business, I had a sign there and they would graffiti it. I'm right by the highway and I'm not there all the time and that's what they do—they come in at night and do their dirty work."

In addition, Hardwick said he might want to sell the building and he does not know how a future owner might feel about the mural. Although his building did not seem to be a good fit for the project, Hardwick said he referred Kim to Gus Niepagen, the owner of Gus's Really Good Fresh Jerky in Olancha.

Niepagen accepted Kim's proposal.

Kim proposed a mural for an additional Independence building, the Pines Café, owned by Los Angeles Department of Water and Power. Jim Yannotta, Manager of the Los Angeles Aqueduct, rejected her proposal.

"First of all, we think having a mural on a building is great and when looking at the murals the artist had done, they are very nice, very inspirational," Yannotta said. However, he explained that the department is "moving forward to offer The Pines for sale at public auction and a mural may not be in best interest of a bidder.

But Yannotta did not completely rule out a mural on a DWP building. "Certainly if the artist had an interest in other facilities or structures, we would be open to that consideration."

Rejections of the widespread Migrating Murals have not been confined to Inyo County.

When Kim proposed a mural along Tioga Pass, on a building owned by Southern California Edison (SCE), the electric company suggested that she gather public comment about the project.

Following up on that suggestion, she delivered her proposal to the Mono Basin Regional Planning Advisory Committee (RPAC).

Bartshe Miller, RPAC member, qualified his response, "That is hard to know for sure, because when Jane's proposal came up, we had very little attendance and response." He said a majority of the members are "in favor of the project, perhaps more people would be if they had more choices of where it could be.

Miller said that Kim proposed a mural for SCE's green building by Ellery Lake. According to Miller, at least two members felt that having "art near that scenic location wasn't appropriate. Other people felt it would be a great mitigation for the impact of the building at that particular location.

"Personally," Miller said, "I think it would be a great asset to the cultural history of the Eastern Sierra."

Inyo County has generally supported murals, and that experience has led to understanding of what works ... and what doesn't.

"Fifteen colorful mural sites showcase the fascinating history of Inyo County on buildings throughout the city," according to the website of The Bishop Mural Society, at bishopmurals.com.

Patty Holton, society president, commented by email, "We feel that good artistic quality reflects the spirit of the community and helps to beautify our already gorgeous landscape. A big part of our mission is to maintain the murals that we have produced for ten years. There are always technical issues when painting on an outside wall, and I hope the artist is careful to do her homework in that regard."

Kim said that the Migrating Murals will be sealed for longevity and that she will return in five years to retouch and to reseal them.

Horton's key determinant regarding "whether these particular murals will be seen as art vs. commercial billboards, is the style of the mural.

Is the painting integrated with its environment?

"From what I can see on [Jane Kim's] website, these murals are planned to be done in a graphic style." she said, "The danger of using this style is that it does evoke some sense of commercialism. However, this may be in keeping with the intentions of the artist. 'Drive by' viewers can see better and perhaps that is what is called for in this particular project."

Eastside muralist and Independence resident David Kirk offered a broader perspective of the Migrating Mural. "I think this project will be an asset to the town. When executed correctly, murals can be an adornment to the community while communicating its unique culture with the value added benefit of becoming a draw to tourism.

"Exeter and Lindsay, California, are two great examples."

To follow updates about the Migrating Mural, visit www.kickstarter.com/projects/45369568/the-migrating-mural/posts/335558

Mural ready to migrate from Indy

1-3-2013

Art project will come to four communities to raise awareness for bighorns

By Paula Brown Williams
Special to The Inyo Register

San Francisco-based artist and science illustrator Jane Kim and her assistant work on the first of four "Migrating Murals" planned for the U.S. 395 corridor to tell the story of the migratory and endangered Sierra Nevada bighorn sheep and the need to protect them. This mural can be found at the Mount Williamson Motel in Independence. The other murals are planned for Olancha, Bishop and Lee Vining. Photos by Charles James

Travelers journeying along U.S. 395, their eyes inevitably drawn to the imposing escarpment of the Eastern Sierra, now have a unique opportunity to glimpse the seldom-seen bighorn that dwell in the most rugged terrain of the mountains. At the south end of the town of Independence, motorists encounter the first in a series of four "Migrating Murals" planned for the highway corridor, which tells the story of the migratory and endangered Sierra Nevada bighorn sheep and the need to protect them.

Each of the life-sized portraits will be a monument to the unique subspecies of bighorn found only in the Sierra Nevada, thanks to the vision of San Francisco-based artist and science illustrator Jane Kim. A highly successful online fundraising campaign took place this fall, raising more than $20,000 in just a few days, allowing Kim to paint the first bighorn mural. The artwork adorns the walls of Paul and Henietta Kenn's Mount Williamson Motel in Independence showing the life stages of a ram from the Mount Williamson herd, depicted befittingly in the shadow of the towering peak.

"Animal migrations are one of the most remarkable behaviors of the natural world, yet they often go unnoticed, even when they take place near centers of human civilization," Kim said. "The purpose of the Migrating Mural is to expose the public to endangered, elusive and transient animals that otherwise go unseen. It highlights animal migration routes while beautifying human migration routes and catalyzes both wildlife conservation and public art."

Three additional bighorn sheep murals, planned for the communities of Olancha, Bishop and Lee Vining, comprise the first chapter of what Kim hopes will become a national community art, education and conservation program. In Kim's words, she aspires to create "art that inspires people to love, appreciate and protect the earth, one work of art at a time. "

The artist and illustrator contemplates future murals for other sensitive species. "Our planet is home to incredible and wondrous life," she said, adding, "I feel most excited, both visually and intellectually in nature. Combining that with my passion for art leaves me with unrefined excitement and sharing even a fraction of that with the rest of the world is the best gift that I know how to give."

A hike with Sierra Nevada bighorn expert John Wehausen inspired Kim to choose the wild sheep as the species to be featured. In a recent report, the artist shared the story of how the bighorn came to the forefront. "I only found out that bighorn existed in the Eastern Sierra while doing a fellowship in Yosemite National Park. I contacted bighorn expert John Wehausen and he invited me to go out into the field with him for two days and track the sheep. From that point on, I was really hooked – just being able to hike the terrain they occupy and see them through spotting scopes was like getting in on a big secret."

Kim, whose background is in fine arts, explained the evolution of her artistic passion. "Any time I saw interpretive signs at a park or flipped through a science journal or a beautifully illustrated field guide, I thought to myself, 'I want to do that.' I flirted with the idea enough times that I finally decided to apply to a very special Science Illustration graduate program at the California State University Monterey Bay. It completely changed my life."

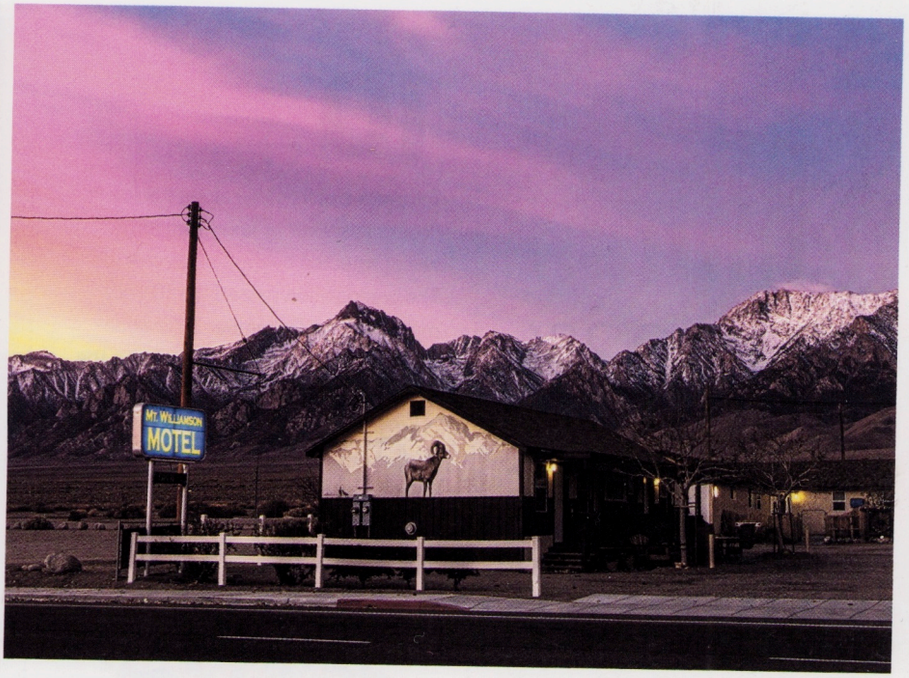
The life-sized portraits are expected to be completed in the next year, bringing more attention to Sierra bighorn and the need to recover from precipitous loss in population. The project, already covered by *National Geographic*, will be featured in the February issue of *O Magazine*. A night of Sierra Nevada bighorn art, education and history, "500 and Rising: Celebrating Sierra Bighorn," followed by a guided field trip the next day, is planned Feb. 16-17 at the Mountain Light Gallery in Bishop. Proceeds will support next mural, which will be painted in Bishop in April.

Part 1 of artist Jane Kim's "Migrating Mural" adorns the walls of Paul and Henietta Kenn's Mount Williamson Motel in Independence, showing the life stages of a ram from the Mount Williamson herd. Photo by Charles James

CALIFORNIA

Roadside Reminders

HIGHWAY MURALS HIGHLIGHT RARE BIGHORNS



WITH SO FEW SIERRA NEVADA BIGHORN SHEEP IN EXISTENCE, a hiker could spend a lifetime roaming California's eastern mountain range without spotting one. But motorists can now catch a glimpse of the endangered bighorns' likeness in a new series of murals painted on the side of four buildings along a 145-mile stretch of U.S. Route 395. The highway, which runs along the east side of the Sierra Nevadas, is "right in the shadow of where [the sheep] live," says the artist, Jane Kim.

The sheep paintings—some of them 20 feet tall—are the first installment of Kim's migrating mural project, which aims to illustrate the life and behaviors of endangered migratory species. "It's hard to spot Sierra bighorns," she says, "which is one of the reasons that people don't even know they're around." Kim herself needed the help of Sierra Nevada bighorn expert John Wehausen, who tracked the sheep with their radio collars and then used a spotting scope to show them to her.

Kim plans to paint more endangered subjects that people rarely get to see, such as coho salmon, North Pacific blue whales and whooping cranes. Kim hopes the murals will raise the profiles of lesser-known fauna and promote awareness and conservation, she says. "The first step of conservation is getting an animal popularized." —CARRIE MADREN

THE ART OF LIFE: Jane Kim's murals evoke the wildlife hidden in the Sierra Nevada mountain range, where the Conservancy is helping protect habitats and water sources.

FAST FACT

500

Genetically distinct from Rocky Mountain and desert bighorns, Sierra Nevada bighorn sheep were listed as endangered in 2000 after disease and overhunting reduced the population to about 100 animals. Since then, conservation efforts have helped the bighorn start to recover: The current population is about 500.

8-2013

500 and Rising: Celebrating Sierra Bighorn

On the evening of February 16th, local conservation organizations and concerned citizens of the Eastern Sierra will partner with a San Francisco-based art studio to host an art exhibit and fundraiser dedicated to protecting the iconic Sierra Nevada bighorn sheep from extinction. From 5:30 to 8pm, Bishop's Mountain Light Gallery will showcase the Migrating Mural, a public art and conservation project created by science illustrator Jane Kim, the founder of INK-DWELL Studio, in partnership with the Sierra Nevada Bighorn Sheep Foundation.

"It is exciting to bring an elusive animal to the forefront and make hard to see wildlife easy to see. But this is just the first step. We need active community support to ensure the recovery of Sierra bighorn," says Kim.

The Migrating Mural is a series of murals depicting endangered animals along migration corridors they share with humans, with the goal of driving support and protection for species in peril. The first chapter of the Migrating Mural showcases Sierra bighorn in four communities along a 150-mile stretch of Highway 395. The first site was completed in November 2012 with two murals at the Mount Williamson Motel in Independence.

To commemorate the completion of the first mural in the Migrating Mural project, as well as the recent growth of the Sierra bighorn population to 500 animals from a low of 100 in the 1990s, the Mountain Light Gallery opens a new guest exhibit, "500 and Rising", on February 16. In addition to Kim's work, the exhibit will showcase local photographers including Andy Selters, Jim Stimson and Moose Peterson, who will share photos of Sierra bighorn habitat, forage, and natural and cultural history. Of more than a thousand endangered species in America, Sierra Nevada bighorn sheep are uniquely poised to achieve recovery.

Opening night, February 16, 2013 from 5:30 – 8:00 pm offers an art auction fundraiser hosted by the Sierra Nevada Bighorn Sheep Foundation. An evening of bighorn education, culture, and history, the fundraiser will also feature brief presentations by guest speakers and a chance to win terrific prizes via raffle and silent auction. John Wehausen, the leading authority on Sierra bighorn, will lead a bighorn-tracking field trip the day after the party on Sunday, February 17. The exhibit runs through April 30, 2013.

MIGRATING MURAL

Raising awareness for the Sierra Nevada bighorn sheep one painting at a time

By Vane

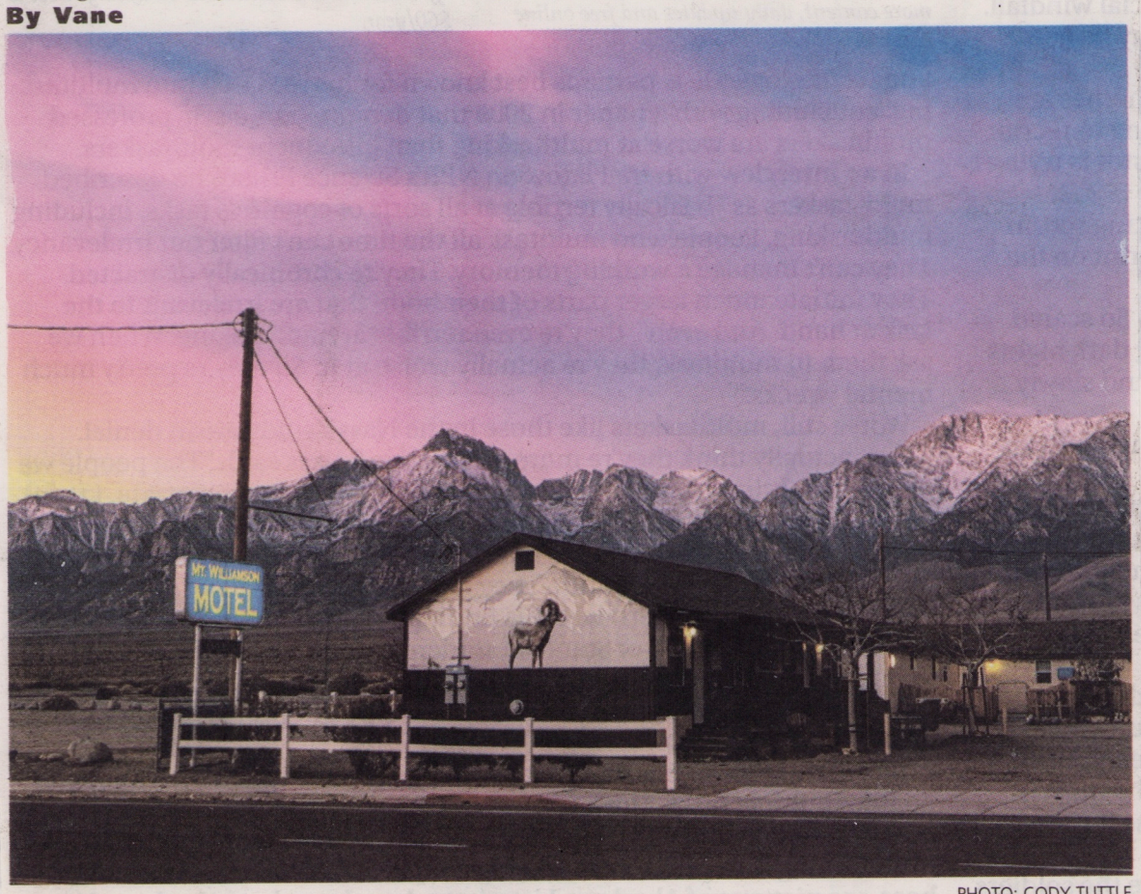


PHOTO: CODY TUTTLE

Kim's depiction of the oldest Sierra Nevada bighorn ram, at Paul and Henrietta Kenn's Mt. Williamson Motel.

Many who drive the Highway 395 corridor between Olancha and Lee Vining may never be aware that a highly endangered species makes it home in the Sierra Nevada mountains. Artist and science illustrator Jane Kim hopes to change that with her Migrating Mural project, a series of murals depicting herd units of the Sierra Nevada bighorn sheep in Lone Pine, Independence, Bishop and eventually Lee Vining.

Kim holds a degree in fine art as well as a graduate certificate in science illustration. The latter degree "changed the trajectory of my career as an artist and allowed me to merge the two areas I really love," she said.

A Bay Area resident, Kim came up with the idea for the Migrating Mural during a long distance road trip in spring of 2010. "I was wondering what else was around here," she said. Then, during a science fellowship with the Sierra Nevada Research Institute in Wawona, she discovered the Sierra Nevada bighorn sheep. "I had no idea they existed before that fellowship," she said.

The Fellowship, and subsequent conversations with Sierra Nevada Bighorn Sheep Foundation President John Wehausen, convinced Kim that bighorn sheep would be the perfect

see MURAL, page 18

MURAL

continued from page 1

species to launch the Migrating Mural. "I fell in love with the animals," she said.

One Kickstarter campaign later, Kim had the funding to complete the first two murals in Independence. Kim began by depicting the oldest Sierra Nevada bighorn ram, as well as the life stages of that ram, at Paul and Henrietta Kenn's Mt. Williamson Motel. "There are eight to twelve herd units in the Sierra," Kim said. "Mount Williamson's is one of the native herd units that survived through near decimation." The herd therefore serves as an iconic reminder of our ability to preserve and recover endangered species.

A second funding campaign through the Mountain Light Gallery in February supported two murals in Bishop. The event, a partnership with the Sierra Nevada Bighorn Sheep Foundation called "500 and Rising," celebrated the recent 500 count of bighorn sheep, which represents two thirds of the recovery goal for the bighorn population. Kim subsequently painted a mural depicting the elevation migration of the Wheeler Crest herd on the Bishop Gun Club, and bighorn seasonal foraging habits, from sage in winter to columbine in summer, at Sage to Summit.

Mural number five, which Kim and assistant Danza Chisholm-Sims are working on at the Lone Pine Airport, was funded through a private donation. The mural "represents how long the Sierra Nevada bighorn sheep has been in the Sierra," Kim said. She noted that molecular dating puts the origin of bighorn sheep in the area at about 300,000 years ago. The mural captures four bighorn sheep traversing a glacier, backed by the silhouette of Mount Langley. "On the mountainside, we're getting a local Tribe member to paint petroglyphs," Kim added.

This particular mural has presented a challenge to Kim and Chisholm-Sims, as it requires painting on corrugated siding. "The time it's taking to paint is one and a half times as long," Kim said, noting that were the siding to be stretched out flat, it would greatly increase the surface area. Where most other murals have taken two to four weeks to complete, this mural will take six to seven, Kim estimated. "This is also the largest mural I've painted so far," she said.

Kim relishes the chance to adapt the style and images of each mural according to the building she chooses to paint. "The design is dependent on what the structure looks like," she said, "and at the same time, I'm trying to tell a story about a sheep's specific unit or biology." She noted that the Sage to Summit mural is a good example of a melding of building and story, as its depiction of bighorn sheep foraging from sage to columbine near mountain summits perfectly suits the building the mural graces. The stucco surface, which made detailed renderings challenging, and the bright colors already on the building allowed Kim to depart from her previous style. "That mural was a bit more stylized and graphic," she said, "but I thought that it worked super well with the building."

As for locating canvases for each mural, Kim said that most building and business owners have been receptive. "It's been awesome," she said. "Some people have said no, but always for a good reason. And when the murals go up, people stop every day to ask and learn about the project."

Sierra Nevada Bighorn Sheep Foundation President John Wehausen offered his praise for the project. "It's easy to forget hard-to-see wildlife," he said. "[The Migrating Mural] exposes the public to endangered, elusive and transient animals that otherwise go unseen."

Kim aims to bring the Migrating Mural to Lee Vining, tentatively to the Mono Basin Visitors Center, in spring. "We're working with the Forest Service," Kim said; "fingers crossed." The Lee Vining mural will depict the bighorn sheep's place in the environment, with silhouettes of other animals within different zones of the Sierra's ecosystem, she said, including a mountain lion stalking the sheep. With this mural, the Eastern Sierra Interpretive Association has become a full-time partner of the Migrating Mural project. "They'll be helping the project gain momentum and exposure, raising funds, and developing ongoing educational opportunities with the murals in mind," she said.

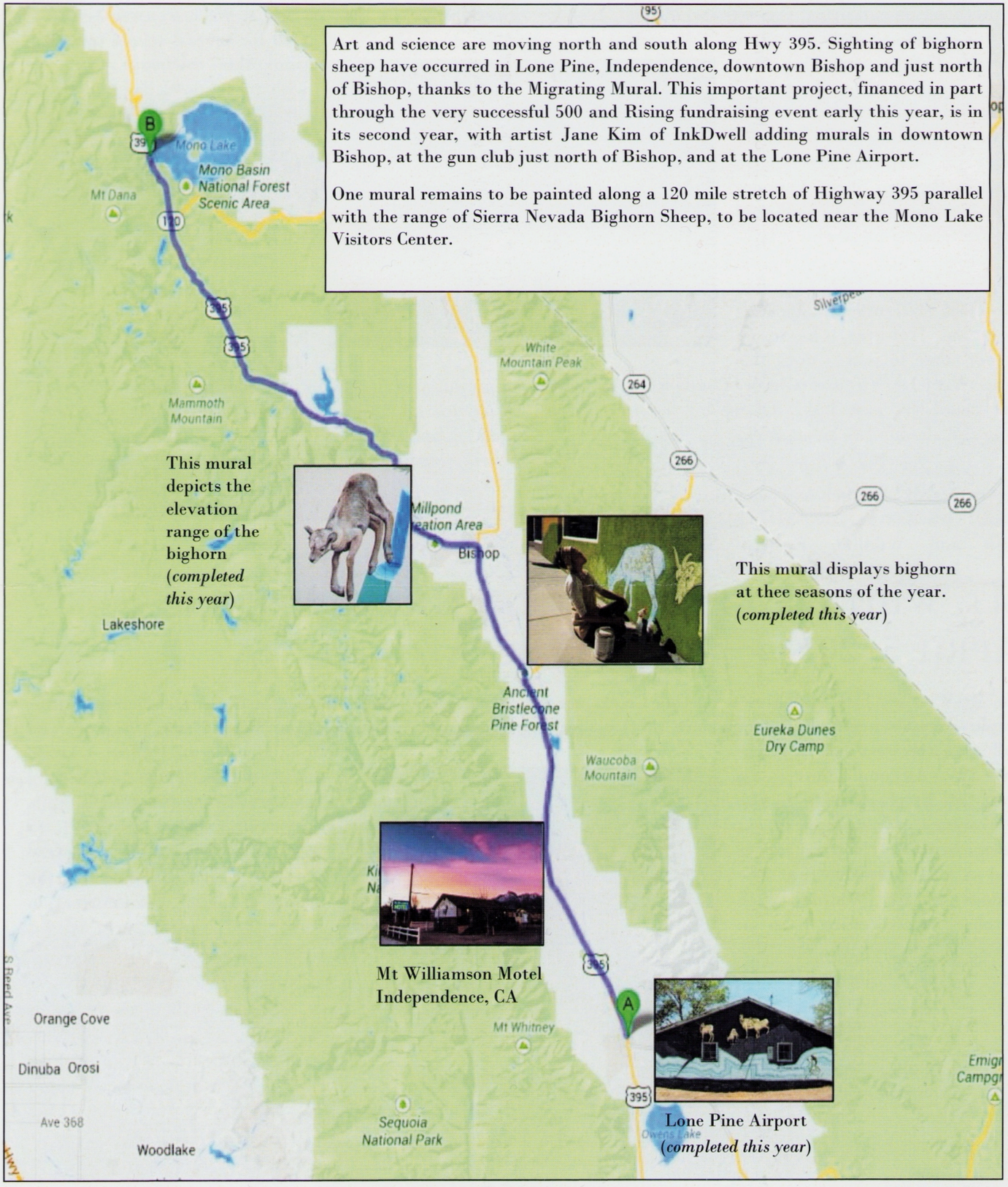
Once completed, Kim hopes the Sierra Nevada bighorn sheep Migrating Mural will "show proof of concept" for a much larger Migrating Mural project. "With the Migrating Mural, I'm trying to create a program that would be ongoing for various [endangered] animals," she explained. Some of these animals could include the Whooping crane or North Pacific blue whale, "animals that have a much larger geographic range." That growth in range would allow the project to grow in breadth and vision, Kim said.

Through partnerships with environmental, public and private sectors, Kim anticipates she could establish a foundation, endowment or grant that would allow her to bring new artists onboard. "I would absolutely love to see that happens in the future," she said.

Migrating Mural Update

Art and science are moving north and south along Hwy 395. Sighting of bighorn sheep have occurred in Lone Pine, Independence, downtown Bishop and just north of Bishop, thanks to the Migrating Mural. This important project, financed in part through the very successful 500 and Rising fundraising event early this year, is in its second year, with artist Jane Kim of InkDwell adding murals in downtown Bishop, at the gun club just north of Bishop, and at the Lone Pine Airport.

One mural remains to be painted along a 120 mile stretch of Highway 395 parallel with the range of Sierra Nevada Bighorn Sheep, to be located near the Mono Lake Visitors Center.



This mural depicts the elevation range of the bighorn (*completed this year*)

This mural displays bighorn at thee seasons of the year. (*completed this year*)

Mt Williamson Motel
Independence, CA

Lone Pine Airport
(*completed this year*)

Dedicated to the Future of Sierra Nevada Bighorn Sheep

JEFFREY PINE journal

CARING FOR THE PUBLIC LANDS OF THE EASTERN SIERRA

SPRING /20

IN THIS ISSUE | *Interrupting Wildlife* | *Anybody's Welcome to Criticize* | *Guarding Our Water*

BIANNUAL NEWSLETTER FRIENDS OF THE INYO VOLUME XVIII, ISSUE I

Bringing bighorns back from the brink

4-10-2014

With success for Sierra Nevada Bighorn Sheep Foundation comes need for public's help

By Jon Klusmire
Special to The Inyo Register

The Sierra Nevada Bighorn Sheep Foundation board of directors – (l-r) Ginnie Chadwick, John Wehausen, Cris Chater and Terri Russi – at the opening of the Sierra Bighorn Sheep exhibit at the Mt. Whitney Fish Hatchery, north of Independence.

Photo by Jon Klusmire

Sierra bighorn sheep spend much of their lives nimbly navigating around cliffs and along rocky ledges far above timberline, displaying an uncanny ability to scramble around what appears to be imminent danger.

And for almost 20 years, the bighorns' balancing act has been shadowed by the Sierra Nevada Bighorn Sheep Foundation. The non-profit group originally worked to pull the bighorns back from the brink of extinction, and is currently working to expand its reach so it can keep up with a string of successes that has seen a steady increase in the number of Sierra bighorn, and successful efforts to transplant and reintroduce the iconic animal to two more of its historic ranges in the Sierra.

In 2012, the foundation and the California Department of Fish and Wildlife, which manages the Sierra Nevada Bighorn Sheep Recovery Program, celebrated a significant milestone when the number of bighorn sheep reached 500, in five separate herds from Lee Vining to Lone Pine. That milestone allowed DFW to begin taking animals from existing herds and transplanting them to new locations, essentially creating a "new" herd. The animals are carefully screened and selected to create a genetically diverse group. When bighorns were released in the Olancha Peak area in 2013, it represented the first attempt to establish a new population in 25 years.

In March of 2014, another group of bighorns was transplanted into a remote part of

See SHEEP, page 3

SHEEP

Continued from front page

Sequoia National Park, called the Big Arroyo, which brought the bighorns back into their historic range in the Kern River Drainage.

Those recent successes are even more remarkable considering there were several times in the past 40 years when the number of bighorns dropped to about 100 animals.

John Wehausen, Ph.D., a foundation board member, has been instrumental in the bighorn research and recovery effort since about 1979, first as a DFW employee and now as a volunteer. He recalled some of the more dramatic moments in the struggle to create a sustainable population of Sierra bighorn sheep.

The decline in the number and range of the bighorn started in the mid-1880s, when white settlers came to the region. By the 1970s, only two small herds remained, numbering about 250 animals in the Independence area. Animals from those herds were transplanted and established "new" herds in three ranges, Wheeler Ridge, north of Bishop, Mt. Langley near Lone Pine, and the Mono Basin. By the mid-1980s, "things were going in the right direction," Wehausen said, with the number of bighorn reaching about 250 to 300 in the various herds.

But three developments in the 1990s conspired to almost wipe out all that progress, and push the bighorn back to the brink of extinction. The same three factors also led to the creation of the Sierra Nevada Bighorn Sheep Foundation

In 1990, California voters approved the Wildlife Protection Act, which made the mountain lion a specially protected animal in California. And starting in 1987, the Eastern Sierra endured drought conditions for the next six years. Finally, funding in the DFW for the bighorn program started to decline.

The "big winter of 1995" hit and delivered plenty of snow, including some wet spring storms. The combination of extended drought, mountain lion predation and the heavy snow "was devastating" to the bighorns, Wehausen said. Of the 100 animals in the Mono Basin herd, only 34 survived, and a dozen bighorn in the Wheeler Ridge herd were killed by an avalanche. "That was definitely a wakeup call," he said. "We needed to really find out what was going on" with each herd.

The need for more monitoring and data collection, along with the need for additional funding, above and beyond what government agencies could provide for the bighorn program, led to the creation of the Sierra Nevada Bighorn Sheep Foundation in 1995. The non-profit foundation's first project was a comprehensive survey of the existing herds. The results of that work were sobering. The Sierra-wide survey revealed there were only about 115 bighorn left.

OVER →

The threat to the sheep from mountain lions remained, and when the DFW asked for a legal opinion about its ability to "control" mountain lions threatening the bighorns, the department was told it could not kill or trap the protected mountain lions, even if they were harming the bighorn, which were classified as a "threatened" species under the California Endangered Species Act.

That promoted the foundation to join with other groups to file for federal endangered species status for the Sierra bighorn. In 1999 that request was granted just three months after the initial filing. "That's about as fast as you can get" a ruling, Wehausen noted.

The federal, endangered species listing superseded state laws regarding mountain lion management, and federal regulations about domestic sheep grazing and other public land policies, he said.

"But the listing didn't bring money or a program," Wehausen said. The publicity from the listing, and the dramatic population decline, prompted the state legislature to act, and fund a "recovery program" within DFW for the bighorn. The initial funding was set for five years, but in a pleasant development, the Legislature made the bighorn funding a permanent part of the DFW budget.

With steady funding to support the DFW Sierra Nevada Bighorn Sheep Recovery Program, the Sierra Nevada Bighorn Sheep Foundation continued to work quietly behind the scenes to support the DFW program.

The foundation continues to be one of many partners in the recovery effort, and continues to provide additional financial support. For instance, it paid some of the costs of the helicopters used in the recent transplant effort. The foundation also is stepping up its outreach and educational programs. The current exhibit of bighorn-related art, videos and information at the Mt. Whitney Fish Hatchery north of Independence is part of that effort, as is the "migrating mural" series of bighorn murals in Lone Pine, Independence and Bishop, said board member Ginnie Chadwick, Ph.D. Chadwick and other board members also make presentations about the bighorn to local schools. (For more information on the foundation's programs, email Chadwick at ginniebeth@me.com, or check the website at http://sierrabighorn.org.)

Ironically, the successes of recent years coupled with reduced state funding for the recovery program has led to an increased need for financial and other support for the program. For example, the higher bighorn populations and the addition of the two "new" herds have increased the costs for monitoring, data collection and ongoing research. Board members noted that is a good problem to have, and said the foundation is once again taking on the challenge by working to enlist the public's support, once again, for the Sierra bighorn sheep recovery program.

end

Bighorns are back in their range

4-13-2014

Fourteen sheep return to a part of the Sierra they haven't occupied for over a century.

By Bettina Boxall

Bighorn sheep are skilled mountain climbers. But one group recently made it over the Sierra Nevada crest in record time.

As part of an ongoing effort to return endangered Sierra Nevada bighorns to more of their historical range, state and federal wildlife workers captured 14 of the animals in the Inyo National Forest and transported them by helicopter to the Big Arroyo area of Sequoia National Park on the range's west side.

The four rams and 10 ewes, all but one of which was pregnant, were moved in late March to a part of the Sierra that bighorns have not occupied for more than a century.

Before settlement, more than 1,000 of the animals are thought to have roamed high elevations of the range from Sonora Pass in the north to Olancha Peak in the south.

California Department of Fish and Wildlife

A BIGHORN SHEEP captured in the Inyo National Forest is checked before its relocation via helicopter.

Their numbers plunged when ranchers started grazing domestic sheep in the Sierra, spreading disease to the bighorn herds. Commercial hunting also contributed to their decline, and by the 1970s only three herds could be found in some of the steepest and most rugged portions of the Eastern Sierra.

Sierra Nevada and desert bighorns are the two bighorn subspecies found in California. The Sierra population has grown to about 500 animals from a low of roughly 100 in 1995.

Last month's operation took place over several days. Workers with the California Department of Fish and Wildlife captured the bighorns one at a time by dropping a net from a helicopter.

The animals, which sport large curling horns, were blindfolded, hobbled and transported to a processing site. Each sheep was examined and fitted with a radio collar and a GPS collar.

They were trucked in aluminum boxes down Highway 395 to near Lone Pine and then flown about 25 miles over the crest to the release site.

Although rams can weigh more than 200 pounds and females more than 100 pounds, the bighorns were not sedated after their capture. Instead they were kept calm with blindfolds and hobbles.

Both were removed for the helicopter ride, and when the boxes were opened to let the sheep scamper into their new home, "they're all just lying in there like there's nothing in the world wrong," said Tom Stephenson, leader of the Sierra Nevada Bighorn Sheep Recovery Program.

Despite the drought, Stephenson said there is adequate forage and water for the sheep in their high-elevation habitat. And the low snowpack has eliminated the danger of deep snow and avalanches.

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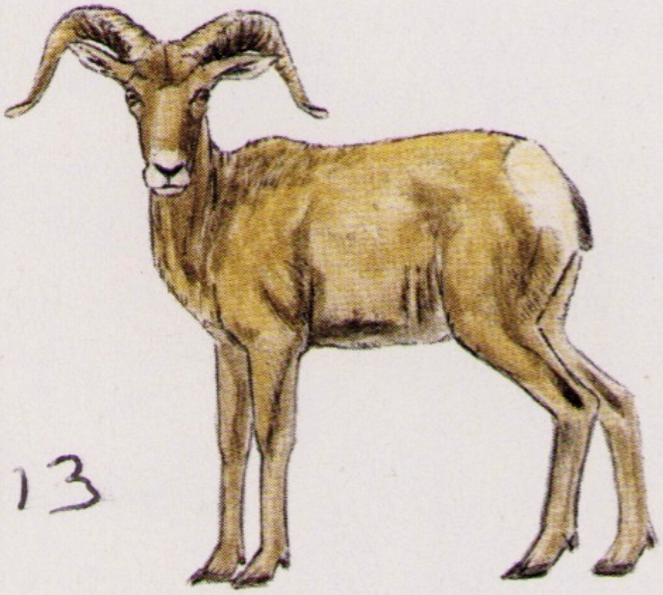
most commonly seen by visitors. Here are some other creatures living in the park that you may observe.



Sierra Nevada Bighorn (male)

BIGHORN SHEEP

The rarest among Yosemite's large mammals is the Sierra Nevada bighorn sheep. The sheep population once numbered in the thousands before 19th century miners hunted them and domestic sheep introduced deadly diseases. By 1999, the Sierra-wide population of bighorn numbered only 125 animals. However, that number is now closer to 400 animals in the wild, thanks to a federal and state endangered species recovery plan that reintroduced bighorn in 1986 near Yosemite's Tioga Pass. Today, the Yosemite herd is closely monitored via GPS satellite radio collars. Your best chance of spotting a bighorn is in the northeastern high country of the park. Slowly pan your binoculars across jagged peaks at elevations above 10,000 feet, where the sheep's padded hooves give them purchase on the crumbly slopes; watch for motion and their distinctive white rear ends.

BEARS

Key to protecting bighorn sheep is controlling mountain lion's numbers 3-7-2013

Like the author of the March 2, 2013 In Appreciation letter, I was also thrilled about the success of the fundraiser for the bighorn sheep; but, let's face it folks, the mountain sheep are being driven into extinction by the mountain lion.

The mountain sheep were having no problem until the government protected the mountain lion. How a state that is $16 billion in debt can justify spending $30 millions a year on an animal that had a bounty on it for 60 years and was never threatened or endangered is beyond me. The lion has got the deer herds down to the lowest point since 1900. He also wiped out the condor (I can prove this).

There is no way that painting a picture of a mountain sheep is going to save one single mountain sheep. I can show you a picture of a mountain lion eating a mountain sheep. Maybe if you painted a picture of that and posted it up on the highway, people could get an idea of what's really going on and get some sense back into the department of Fish and Game.

There is also a bill in the Senate to protect the bobcat. Little do these people know that the big toms find it much easier to prey on the females and eat their kittens than it is to catch a rabbit. There is certainly no shortage of bobcats in California and the best way to manage the bobcat, like the lion, is to control their numbers.

Duane Rossi
Big Pine

Bighorn Sheep local history binder

Compiled by Bob Larson (1934-2024).

Collection of magazine articles, newspaper clippings, and other printed ephemera related to Sierra Nevada bighorn sheep (ovis canadensis sierrae) and desert bighorn sheep (ovis canadensis nelsoni).

Background (from Wikipedia): *"The bighorn sheep (Ovis canadensis) or bighorn is a species of sheep native to North America. It is named for its large horns. A pair of horns may weigh up to 14 kg (30 lb); the sheep typically weigh up to 143 kg (315 lb). Recent genetic testing indicates three distinct subspecies of Ovis canadensis, one of which is endangered: O. c. sierrae.*

Sheep originally crossed to North America over the Bering Land Bridge from Siberia; the population in North America peaked in the millions, and the bighorn sheep entered into the mythology of Native Americans. By 1900, the population had crashed to several thousand due to diseases introduced through European livestock and overhunting."

Binder compiled by/from the collection of Robert Wood "Bob" Larson (1934-2024). Bob Larson was a teacher at Salinas High School in Salinas, California for many years. He inherited his aunt Enid A. Larson's home in Big Pine, Inyo County, California in 1991, and permanently relocated to Big Pine in 2013. He continued his aunt Enid's penchant for Owens Valley History, and he collected articles and books on the natural and human history of Inyo County.

Includes a listing of contents at the end of the document, created by ICFL staff in Feb 2026.

Item from the collection of the Inyo County Free Library local history room collection. Scanned in February 2026.

Binder contents (in order of appearance):

Picture on cover of binder shows bighorn sheep, taken from unknown publication.

Clipping from unknown publication: "Elk & Pronghorn Season Summaries – Summary of 2009/2010 Pronghorn Antelope Hunting Seasons".

Clipping from unknown publication (hand dated "11-18-2012") titled "Sierra bighorn".

Clipping from unknown publication (hand dated "2016"), titled "Strength in numbers" and featuring image of Sierra Nevada bighorn sheep in Pine Creek Canyon, Inyo County.

Newspaper clipping: *Inyo Register* (Bishop, Inyo County, California), 14 May 2020, p. 4. "The endangered Sierra Nevada Bighorn sheep."

Newspaper clipping: *Inyo Register*, first published 10 Sep 2016, p. 17 (reprinted 21 Nov 2020, p. 12). "John Muir may have personally seen only a few Sierra bighorn…"

Newspaper clipping: *Inyo Register*, first published 10 Sep 2016, p. 17 (reprinted 21 Nov 2020, p. 12). “Sierra Nevada Bighorn Sheep are genetically unique…”

Newspaper clipping: *Inyo Register*, 2 Apr 2016, p. 16. “Some Sierra Nevada bighorn high on a mountain ridge…”

Newspaper clipping: *Inyo Register*, 30 Dec 2010, p. 3. “Holy sheep”.

Newspaper clipping: *Inyo Register*, 10 Apr 2014, p. 1. “These skulls show the difference between desert bighorn sheep…”

Magazine article: *Smithsonian*, [official website dates article as 31 May 2000], p. 91-100 “Horning In? – Bighorn sheep have made a comeback in recent years, but some developers out West think they’re intruders.” By Steve Kemper.

Magazine article: *Sierra Life*, Nov-Dec 1983, Vol. 3 No. 2, p. 16-20. “Sierra Wildlife column: Bighorn Sheep of the Sierra Nevada – After 130 years of decline, are they making a comeback?” Text and photos by Mike McWherter.

Newsletter article: *Sierra Nevada Bighorn Sheep Foundation* newsletter, Dec 2013, p. 1-4.

Magazine article: *National Wildlife*, August/September 2011, cover and p. 34-37. “Battle for Bighorns: Compromise and Conservation in the West.”

Newspaper article: *The Monterey County Herald* (Monterey, California), 26 Jun 2011, p. A3. “Bighorn sheep face challenges – Lions threaten species.”

Newspaper article: *Mammoth Times* (Mammoth Lakes, Mono County, California), hand dated 24 Nov 2012. “The battle over the bighorn.” By Wendilyn Grasseschi.

Clippings and / or website printouts from unknown source regarding Sierra Nevada bighorn sheep. “In 1995, the population of the Sierra Nevada Bighorn Sheep hit an all time low…”

Newspaper article: NewsBank website printout of *San Francisco Chronicle*, 6 May 2007. “Staring down bighorns in Inyo.” Printed 22 May 2007.

Article from unknown publication, undated: “A different sort of sheep man.” By Ken Birchim. Article covers John Wehausen’s studies of bighorn sheep in the Sierra Nevada and White Mountain ranges.

Magazine article: *Outdoor California*, January-February 2018, p. 35-38. “Threshold of Recovery – Future no longer on the edge for three endemic and endangered species from the Eastern Sierra’s Owens Valley.” Story by Gigi de Jong.

Magazine article: *Smithsonian*, March 2008, p. 24. “No more than 600 bighorn…”

Magazine article: *Outdoor California*, January-February 2010, p. 29-32. “Floating Menace: Researchers say latex party balloons pose a unique threat to southern California’s population of bighorn sheep because of the way sheep eat and digest food.” Story by Rebecca Barboza.

Magazine article: *Mammoth Sierra Magazine*, undated. “Catch & Release.” Article on Sierra bighorn.

Newspaper article: *Inyo Register*, 27 Mar 2010, p. A12. “Several areas will be burned to help endangered species.” Article on controlled burns for the benefit of bighorn sheep.

Article from unknown publication, hand dated 21 Apr 2018. “Wildlife: A Field Trip to See Sierra Nevada Bighorn Sheep.” By Rea. [Possibly *The Sheet* of Mammoth Lakes CA]

Article from unknown publication, hand dated 21 Apr 2018. “Counting Sheep.” By Bodine. [Possibly *The Sheet* of Mammoth Lakes CA]

Photograph from unknown / undated publication of a bighorn sheep lamb perched on a rock.

Newspaper article: *The Sheet*, 22 Sep 2018, p. 13. “A Modern Day Muir.” By Gorman.

Newspaper article: *The Sheet*, 3 Nov 2018, p. 8-9. “Vigilante Genetic Biologist: Dr. John Wehausen runs a genetics laboratory out of a cabin in Bishop to save the Sierra Bighorn.” By Gorman.

Pamphlet: The Sierra Nevada Bighorn Sheep Recovery Program. California Department of Fish and Game, Bishop, California Office. No date.

Newspaper article: *Inyo Register*, 11 Mar 2017, p. 5. “Mono County votes to end sheep grazing on Conway.” By Wendilyn Grasseschi. [Possibly also reported in *Mammoth Times*]

Newspaper article: *The Sheet*, 1 Jul 2017, p. 6 “A Rough Winter For Bighorn Sheep – Local backcountry skier stumbles upon ‘graveyard’ from avalanche.” By Rea.

Press release document: “Endangered Sierra Nevada Bighorn Sheep Restored to Yosemite and Sequoia National Parks.” National Park Service, Sequoia & Kings Canyon Office. Website dates release to 30 Mar 2015.

Color photograph of bighorn sheep on hillside from unknown source, no date.

Newspaper article: *Inyo Register*, 10 Sep 2016, p. 17. “The fall and rise of the Sierra Nevada bighorn sheep.” [Text does not include title, starts with text: “Hidden among the granite peaks…”]. By Ted Williams.

Newspaper article: *Inyo Register*, 24 Sep 2016, p. 1, 3. “Frog designation to leap on economy – Federal classification could shut down popular rec areas.” By Kristina Blüm.

Unknown document: “Bishop – Helping the Herd.” Hand dated “2011.” Two page document describing history and conservation of bighorn sheep.

Newspaper article: *Inyo Register*, 6 Apr 2013, p. A1 “Southern Sierra gets first new sheep herd in 100 years – Department of Fish and Wildlife relocates bighorns to Olancha Peak area to re-establish species there.” By Mike Gervais.

Unknown document: “The Bravest of All the Sierra Mountaineers.”

Color photograph captioned “Big Horn Sheep of Silver Canyon – Photo by Ann Aylesworth.”

Color photograph captioned “Desert Bighorn Ram – November 2018 – Photo by Dana Felthauser.”

Magazine article: *Jeffrey Pine Journal*, hand dated “2020.” “Wildlife Interrupted - Scientists are documenting the profound impact of human-powered recreation on imperiled wildlife during the winter.” By Hilary Eisen (Policy Director of Wildlands Alliance), introduction by Wendy Schneider (executive director, Friends of the Inyo).

Magazine article: *Smithsonian*, March 2008, p. 21-22. “Tracking the Bighorns: Where do the elusive mountain climbers go? Researchers have finally learned some answers.” By Becky Lomax.

Newsletter: *Sierra Nevada Bighorn Sheep Foundation* newsletter, Dec 2015, p. 1-4.

Magazine article: *Sun Runner*, June/July 2011, p. 34. “The Way of Things: The Desert Bighorn Sheep of the Mojave Desert.” By Carlos Gallinger.

Newspaper article, unknown publication [*Inyo Register*?], hand dated 13 Oct 2011. “DFG wants to land helicopters in wilderness – Proposal part of effort to help recovery of bighorn sheep population.”

Color advertisement for “California Big Game Hunting,” dated 2012, prominently featuring a bighorn sheep.

Magazine article: *Big Game Hunting*, 2013, p. 26. “The Luck of the Draw.” By Regina Abella. Article about Brigitte Mullen winning California Department of Fish and Wildlife lottery and successfully shooting a desert bighorn in the Mojave Desert.

Magazine article: *Outdoor California*, September-October 2014, p. 29-33. “Along a Far Horizon: Encounter with desert bighorn sheep in the Sespe Wilderness means herd once thought lost may be reviving.” Story by Chuck Graham.

Unknown periodical: “Keeping Public Lands Public: The National Wildlife Federation and its affiliates mobilize sportsmen and other outdoor enthusiasts to fight state efforts to seize public lands.”

Pencil drawing of bighorn sheep.

Photo of sheep captioned: “The well-turned headgear of Dall sheep makes them prized trophies for hunters.”

Advertisement [?] for The Alaska Sportsman featuring a bighorn sheep on a rocky hillside.

Various unlabeled, undated newspaper / magazine clippings related to bighorn sheep.

Magazine article: *Mammoth Sierra Magazine*, February-March 2013, p. 21-23. “Jane Kim’s ‘Migrating Mural’ brings bighorn sheep into focus: Rarely seen in the mountains, the bighorns are now in plain view… on the surfaces of Eastside structures.” Details Kim painting murals on various buildings throughout Inyo and Mono Counties, including locations in Olancha, Bishop, Mammoth Lakes, Mono Basin Visitors Center, and Mount Williamson Motel in Independence.

Newspaper article: *Inyo Register*, 3 Jan 2013, p. 1. “Mural ready to migrate from Indy – Art project will come to four communities to raise awareness for bighorns.” By Paula Brown Williams.

Magazine article: *Nature Conservancy Magazine*, hand dated Aug 2013, p. 23. “California – Roadside Reminders: Highway Murals Highlight Rare Bighorns.”

Newspaper article: *Inyo Register*, 26 Jan 2013, p. A12. “500 and Rising: Celebrating Sierra Bighorn.”

Newspaper article: Unknown publication [possibly *The Sheet*], 30 Nov 2013. “Migrating Mural: Raising awareness for the Sierra Nevada bighorn sheep one painting at a time.” By Vane.

Newsletter article: Unknown publication [possibly *Sierra Nevada Bighorn Sheep Foundation*], undated, p. 6: “Migrating Mural Update.”

Magazine article: Cover of *Jefferey Pine Journal*, Spring 2020. Features image of bighorn sheep on snow-covered hillside.

Newspaper article: *Inyo Register*, 10 Apr 2014, p. 1, 3. “Bringing bighorns back from the brink: With success for Sierra Nevada Bighorn Sheep Foundation comes need for public’s help.” By Jon Klusmire.

Newspaper article: *Los Angeles Times*, 13 April 2014, p. A23. “Bighorns are back in their range: Fourteen sheep return to a part of the Sierra they haven’t occupied for over a century.” By Bettina Boxall.

Clipping from unknown publication: “Bighorn Sheep – The rarest among Yosemite’s mammals…” Hand dated 2013.

Newspaper article: *Inyo Register*, 7 Mar 2013, p. 4. Letter to the editor. “Key to protecting bighorn sheep is controlling the mountain lion’s numbers.” By Duane Rossi

[Content list revised 18 Feb 2026, MS-ICFL]